



GOVERNMENT OF ASSAM



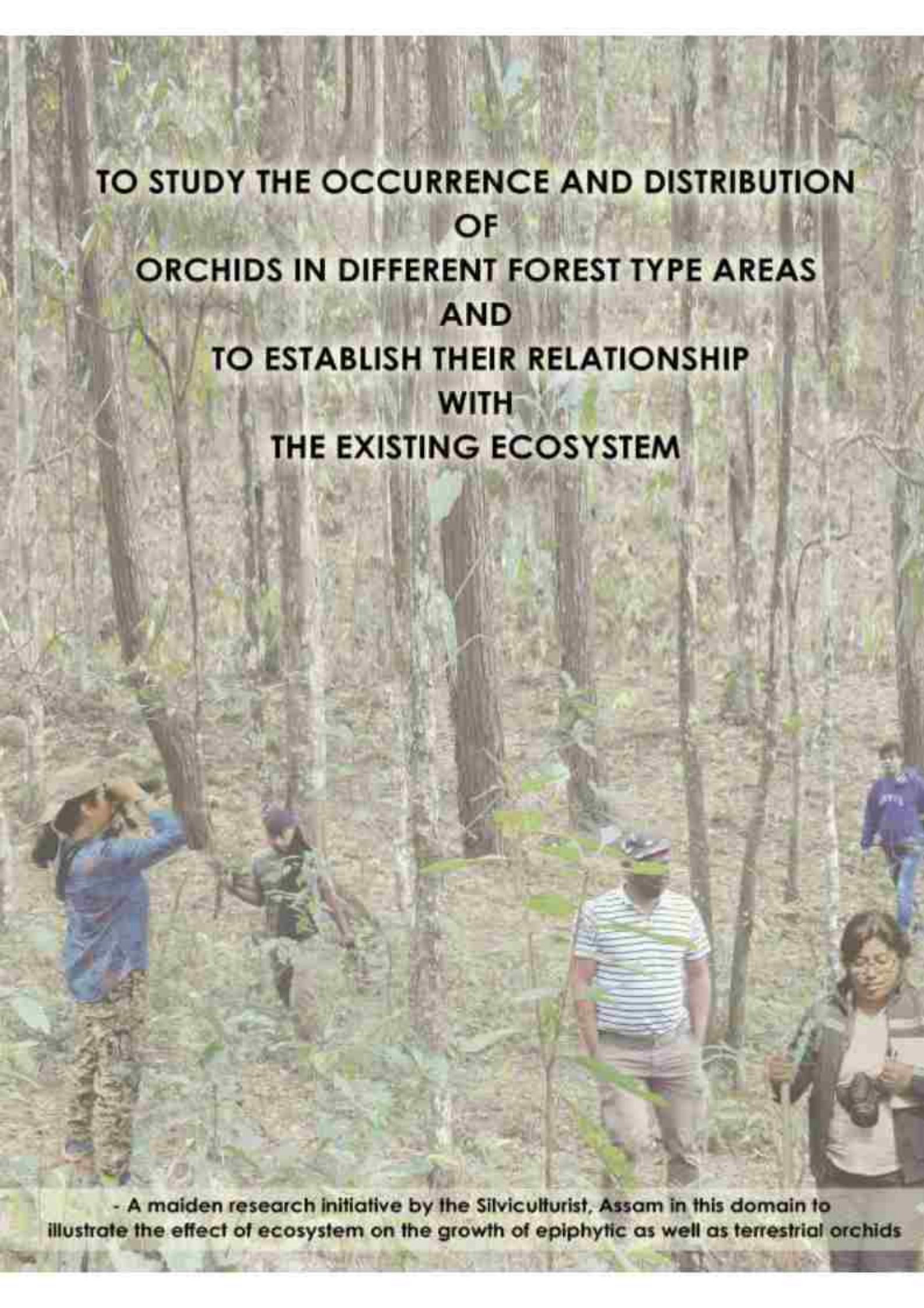
FOREST DEPARTMENT, ASSAM

RESEARCH REPORT ON IN-SITU STUDY OF ORCHIDS CARRIED OUT IN 5 PLOTS OF DIFFERENT FOREST TYPES IN ASSAM

- UMJAKHINI
- JEYPORE
- BORDUAR
- GARBHANGA
- KHOLAHAT

Eria Rhatapetala

Office of the Silviculturist, Assam
Basistha, Guwahati-29



**TO STUDY THE OCCURRENCE AND DISTRIBUTION
OF
ORCHIDS IN DIFFERENT FOREST TYPE AREAS
AND
TO ESTABLISH THEIR RELATIONSHIP
WITH
THE EXISTING ECOSYSTEM**

- A maiden research initiative by the Silviculturist, Assam in this domain to illustrate the effect of ecosystem on the growth of epiphytic as well as terrestrial orchids

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ড° অলকা ভার্গৱ, ভাঃবঃসেৱাঃ
Dr. Alka Bhargava, IFS



প্ৰধান মুখ্য বন সংৰক্ষক ও বন বল মূবক্ষী, অসম
Principal Chief Conservator of Forests
& Head of Forest Force, Assam



Message

The rich biodiversity of the Brahmaputra and Barak basins ranging from the evergreen rainforests of Upper Assam to sal in Lower Assam as well as the rich bamboo brakes, provide a unique opportunity to foresters to research and document each of these unique ecosystems while on their 'duty' trails.

I congratulate the Silviculture Division of Assam Forest Department under the leadership of Shri Dibakar Deb, AFS to have carried out this study on orchids in 5 different forest types of the State in order to establish a relation between their growth and the habitat. This is a maiden endeavour of our Department in this domain, hence becoming a baseline for further research by field foresters, students and academicians alike.

Assam has a huge untapped potential to become a leader in production of cut orchids as well as planting material of the non – schedule species as an additional source of livelihoods for our communities. Silviculture Division may guide such programs for the forest fringe communities and other private entrepreneurs, both for conservation of the endemic species as well as commercial production.

I encourage the Research, Education and Working Plans wing of the Forest Department to continue to guide the activities of the Department to optimize outcomes to improve the health of our forests and tree cover.

Alka Bhargava.

(Alka Bhargava)

PREFACE



The state of Assam lies in the Indo –Burma Biodiversity Hotspot area, where orchid is found growing in 7 (seven) Forest Type areas. Orchid is an indicator species of a healthy ecosystem. Diversity and availability of orchids found in the abovementioned forest types indicate that moderate to dense forests are excellent habitat of both epiphytic and terrestrial orchids and the fact of a healthy ecosystem could be experienced by a remarkable local microclimate and orchid friendly host trees in the orchid growing patches.

A need was felt for a study of growth of both epiphytic and terrestrial orchids in a certain ecosystem to find out the key attributes responsible for mutual relation and dynamics between orchid growth and the existing ecosystem. Consequently, 5 (five) nos of plots were identified falling in 5 different forest type areas for the study. A detailed analytical study was carried out after collecting data along with subsequent analysis where an effort has been made to illustrate the dynamics of growth of orchids in those ecosystems.

The data collection was started during Jan'21 by utilizing the required fund released through State CAMPA. In spite of several constraints, the data collection team comprising of Smt. Preeti Buragohain, AFS, ACF, Smt. Himamoni Handique, Research Officer, Niral Das, RO (Retd.) Pranjol Das, Fr-I, Himangshu Bhattacharjee, Fr-I, Hirok Hindol Sarma, Fr-I, and Hitesh Das Fr-I led by Sri Sailen Das, AFS, the erstwhile Silviculturist did a commendable job to visit the difficult sites and collecting data.

Subsequently, a data analysis team comprising Smt. Preeti Buragohain, AFS, ACF, Smt. Himamoni Handique, Research Officer and Pranjol Das, Fr-I led by the undersigned carried out entire data analysis and a comprehensive report was prepared and published.

I would like to extend my gratitude to my superiors for their continuous guidance and members of the two teams contributing to this effort.

Dated Guwahati the 23rd December, 2021

A handwritten signature in blue ink, appearing to read 'Dibakar Deb', with a long horizontal stroke extending to the right.

*(Dibakar Deb, AFS)
Silviculturist, Assam*

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IDENTIFICATION & STUDY OF 5 NOS OF ORCHID PRESERVATION PLOTS WITH AN AREA OF 5 HA EACH HAVING NATURALLY RICH CONCENTRATION OF INDIGENOUS ORCHID SPECIES UNDER DIFFERENT FOREST TYPES OF ASSAM

1. BACKGROUND:

Species diversity indicates the number of species of plants and animals present in a region. Maintaining a wide diversity of species in each ecosystem is necessary to preserve the web of life that endures all living things. Biological diversity is also essential for preserving ecological mechanisms such as fixing and recycling of nutrients, soil formation, circulation and cleansing of air and water, global life support, subsequent carbon sequestration maintaining the water balance within ecosystem, watershed protection, maintaining stream and river flows throughout the years, erosion control and local flash flood reduction.

2. NEED:

Focusing the attention on orchids available in North-east, as many as 182 species of orchids are identified in Assam as per BSI estimate. Tropical Wet Evergreen Forests of Tinsukia district and its adjoining foot hills of Arunachal Pradesh is very much rich and more than hundreds of eye-catching and colourful wild orchids are seen to bloom throughout the year. Mostly they are epiphytes. Orchids grow best in evergreen and semi-evergreen forests and to some extent in moist deciduous forests. Silviculture division has taken initiative to identify orchids and their in-situ study which are growing in different agroclimatic zones with a perspective of relationship dynamics between the orchids and their hosts in the ecosystem found in those forest areas.

- 3. OBJECTIVE OF THE STUDY:** To study the occurrence and distribution of orchids in different forest type areas and to establish their relationship with the existing ecosystem. The study includes species to species relationship dynamics between orchid and host tree species particularly the extent of distribution among tree species and also the diversity of host trees with respect to the orchid species.

4. METHODOLOGY:

Following steps were involved -

- 4.1 Reconnaissance survey
- 4.2 Plot identification and demarcation
- 4.3 Identification of host trees and orchids
- 4.4 Enumeration and marking of host trees bearing orchids
- 4.5 Collection of data on climate and soil
- 4.6 Rehabilitation of wind fallen orchids
- 4.7 Data Analysis and deriving inference

5. WORKS CARRIED OUT IN THE FIELD:

As per the methodology, the details of activities carried out in the field are furnished below -

5.1 Reconnaissance survey:

To begin with, the orchid study/preservation plots were selected based on the preliminary survey done by the frontline staff of the Silviculture division along with the staffs of respective divisions where orchid study plot lies. And the areas were chosen after knowing the sufficient availability of epiphytic as well as terrestrial orchids in that particular forest or division.

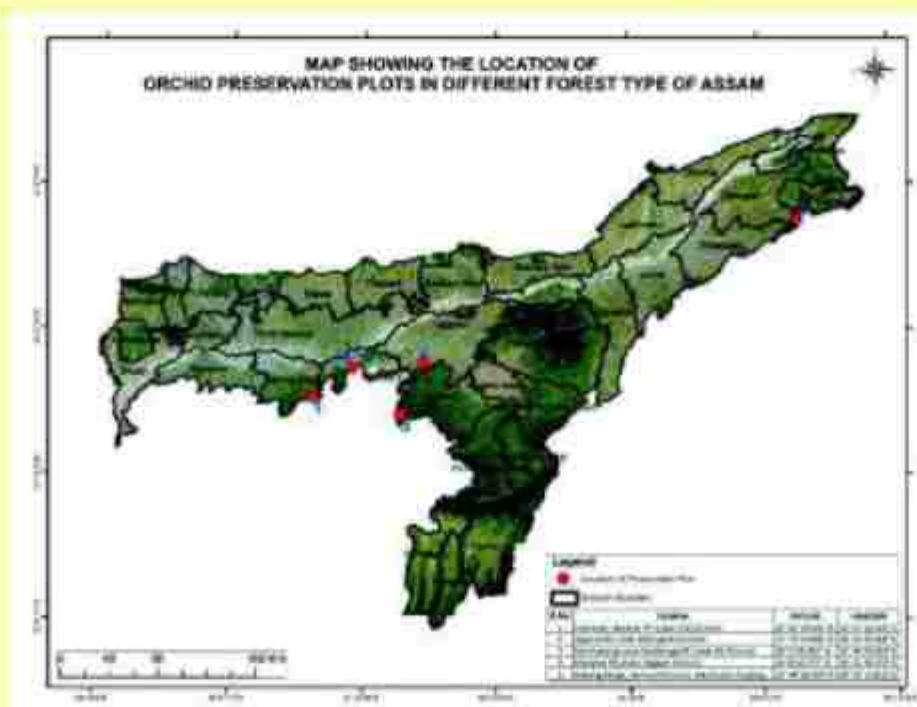
5.2 Plot identification and demarcation:

After the reconnaissance survey, 5 nos of preservation cum study plots (5 ha each) were finalized for in-depth study of availability of different species of orchids, soil pH, soil temperature and macro nutrients as well as determination of atmospheric temperature and humidity. Accordingly, GPS coordinates were noted and GPS maps were prepared for each preservation plot. Plots were demarcated using hand held GPS after tracing along the GPS maps prepared during the time of preliminary survey. The boundaries of the plots were demarcated by painting the trees in stripes standing along the boundary line at breast height. In order to easily identify the plot from a distance bright Red and Yellow colours were used for boundary demarcation. In case of boundary trees bearing orchids, those were encircled with white paint in addition to that of Red and Yellow.

5 (five) nos of plots chosen for in-situ study of orchids

Sl. No.	Particulars of the Works	Location	GPS Points
1	Identificational of 5 nos. of Preservation plots with an area of 5.00 Hact. each having naturally rich concentration of indigenous Orchid species for executing in-situ conservation under different forest areas of Assam.	Near Rajapara Beat in Boeduar RF (Chandubi) under Kamrup West Divn.	1. N - 25°52' 20.68" E - 091°27' 02.74" 2. N - 25°52' 18.90" E - 091°27' 05.18" 3. N - 25°52' 19.47" E - 091°27' 08.05" 4. N - 25°52' 22.78" E - 091°27' 10.95" 5. N - 25°52' 25.72" E - 091°27' 13.37" 6. N - 25°52' 27.04" E - 091°27' 16.00" 7. N - 25°52' 27.58" E - 091°27' 18.81" 8. N - 25°52' 30.48" E - 091°27' 13.10"
		Jeypore RF under Dibrugarh Divn.	1. N - 27°11' 54.8" E - 095°27' 01.0" 2. N - 27°11' 56.1" E - 095°26' 54.4" 3. N - 27°11' 46.98" E - 095°26' 55.15" 4. N - 27°11' 50.50" E - 095°26' 49.70"
		Panchakanya area in Garhlanga RF under Kamrup East Divn.	1. N - 26°05' 29.6" E - 091°46' 45.0" 2. N - 26°05' 31.0" E - 091°46' 44.0" 3. N - 26°05' 32.1" E - 091°46' 44.8" 4. N - 26°05' 34.34" E - 091°46' 45.09" 5. N - 26°05' 36.66" E - 091°46' 46.16" 6. N - 26°05' 38.05" E - 091°46' 47.0" 7. N - 26°05' 39.4" E - 091°46' 48.0" 8. N - 26°05' 40.74" E - 091°46' 49.67" 9. N - 26°05' 38.34" E - 091°46' 56.87" 10. N - 26°05' 37.64" E - 091°46' 55.61"

		11. N - 26°05' 32.89" E - 091°46' 49.64"
	Kholahat RF under Dharamtul Range, Nagaon Territorial Divn.	1. N - 26°08' 05.95" E - 092°21' 55.45" 2. N - 26°08' 11.53" E - 092°22' 05.35" 3. N - 26°08' 15.52" E - 092°22' 01.94" 4. N - 26°08' 10.19" E - 092°21' 52.22"
	Umjakhini Beat office under Habang Range (Hamren Division), West Karbi Anglong	1. N - 25°44' 52.85" E - 092°10' 18.37" 2. N - 25°44' 47.74" E - 092°10' 17.51" 3. N - 25°44' 53.15" E - 092°10' 07.95" 4. N - 25°44' 47.09" E - 092°10' 07.96"



Boundary Demarcation of the plots

5.3 Enumeration and marking of trees bearing orchids:

After demarcating the boundary of the plot, enumeration and marking of trees bearing orchids was done by painting the trees in stripes with white

paint at breast height and were numbered. Simultaneously, the host trees along with the names of orchid species present were recorded by observing the orchids with the help of binoculars. Orchid species diversity on a single host tree (species-wise) as well as species diversity of host trees which houses each orchid species were studied and data collected accordingly. During collection of data, data on availability of terrestrial orchid species were also noted which were present in the plot. Some rare ground orchid species were recorded in some places.



Marking of orchid bearing trees

5.4 Soil sampling procedure for Soil analysis:

To determine the general characteristics of soil as well as specific characteristics of soil where terrestrial orchid species were found, soil samples were collected with the help of trowel and spade using the following methodology -

- 5.4.1 Removing the surface litter at the sampling plot
- 5.4.2 Making a 'V' shaped cut to a depth of 15 cm in the sampling spot using spade or trowel
- 5.4.3 Removing thick slices of soil (1 cm) from top to bottom of exposed faces of the 'V' shaped cut and placing in a clean container.

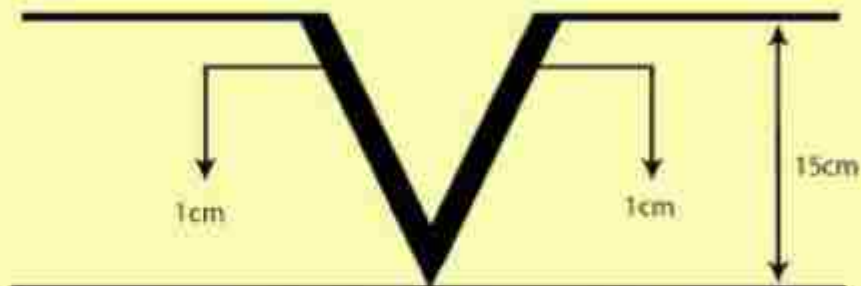


Fig 1. V-shaped cut for soil sample collection

- 5.4.4 For an area covering 1 Ha, 8-10 samples were collected.
- 5.4.5 Mixing the samples thoroughly and removing foreign materials like roots, stones, pebbles and gravels.
- 5.4.6 Rubbing the samples with hand to make uniform soil particles and drying them in the shade for two consecutive days.
- 5.4.7 Reducing the bulk to about 200-250 grams by quartering method.

- 5.4.7 Reducing the bulk to about 200-250 grams by quartering method.
- 5.4.8 Quartering is done by dividing the mixed sample thoroughly into four equal parts. The two opposite quarters are discarded and the remaining two quarters are remixed and the process is repeated until the desired sample size is obtained.
- 5.4.9 The sample size thus obtained i.e. 200-250 grams of soil is then packaged in an air-tight polythene bag.
- 5.4.10 The samples so collected were sent to District Agricultural Office, Ulubari for analysis of soil pH and macro nutrient status.



Soil Sample Collection

5.5 Atmospheric data:

Local atmospheric data such as temperature, humidity, soil temperature was collected using digital thermo-hygrometer and soil thermometer respectively.



Recording of atmospheric data

5.6 Rehabilitation of orchids:

While exploring the plot, some epiphytic orchids were observed lying in the forest floor which might have been displaced due to wind or other natural disasters. Those wind fallen orchids were rehabilitated in the living trees with the help of coconut rope by the data collection team.



Observing wind fallen orchids

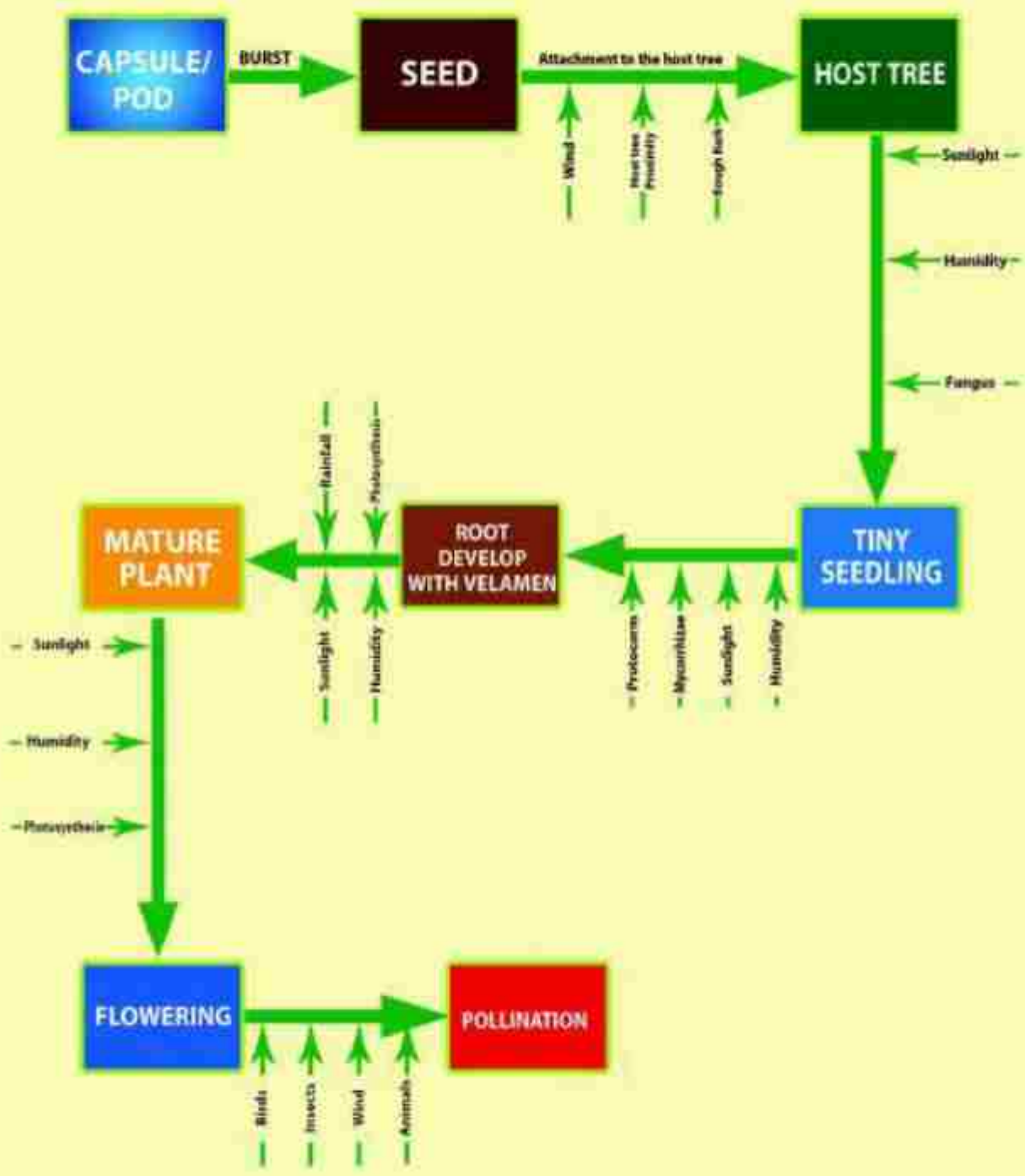


Rehabilitation in the living trees

6. DATA ANALYSIS & INFERENCE: The data analysis was targeted to achieve the outcomes of the objectives set for the study of orchid plots i.e. identification of orchids and its relationship dynamics with the ecosystem. Compilation of data collected from the field were digitized and analysed both statistically and qualitatively with the help of computer applications for generating outcome reports, maps, charts and tables. The data analysis report was validated with past publication resources and secondary virtual data and the final report is prepared and published. Statistical analysis on the Data reliability (*one tailed & two tailed p-value*). Extent of biodiversity of both Epiphytic Orchids & Host trees as well as Species richness by calculating Shannon's biodiversity index (H), subsequently Epiphytic Orchid Equitability was also deduced numerically. For calculations of these above values, MS Excel program was used.

- For ascertaining the significance of categoric (*non-numeric*) data, **t-test for two sampled assuming unequal variances** was carried out. From which one tailed & two tailed p-value was derived to ascertain the statistical significance of non-numeric data collected during field exercise.
Max value of p is 0.05 for both one tailed and two tailed.
- **Shannon's Biodiversity Index (H)** = $\sum \ln p \times p$, where, **p** is probability of availability of individual species and **lnp** is natural logarithm of **p** **Equitability** = $\frac{H}{H_{max}}$, where, **H_{max}** is natural logarithm of total number of varieties of species
Value of Equitability ranges from 0-1.
- **Biodiversity** = $\frac{N(N-1)}{\sum n(n-1)}$, where, **N** is total number of orchid species sightings, **n** is number of individual species sightings.
Higher the value, higher is the biodiversity and this value is used for comparing the extent of biodiversity amongst different plots.

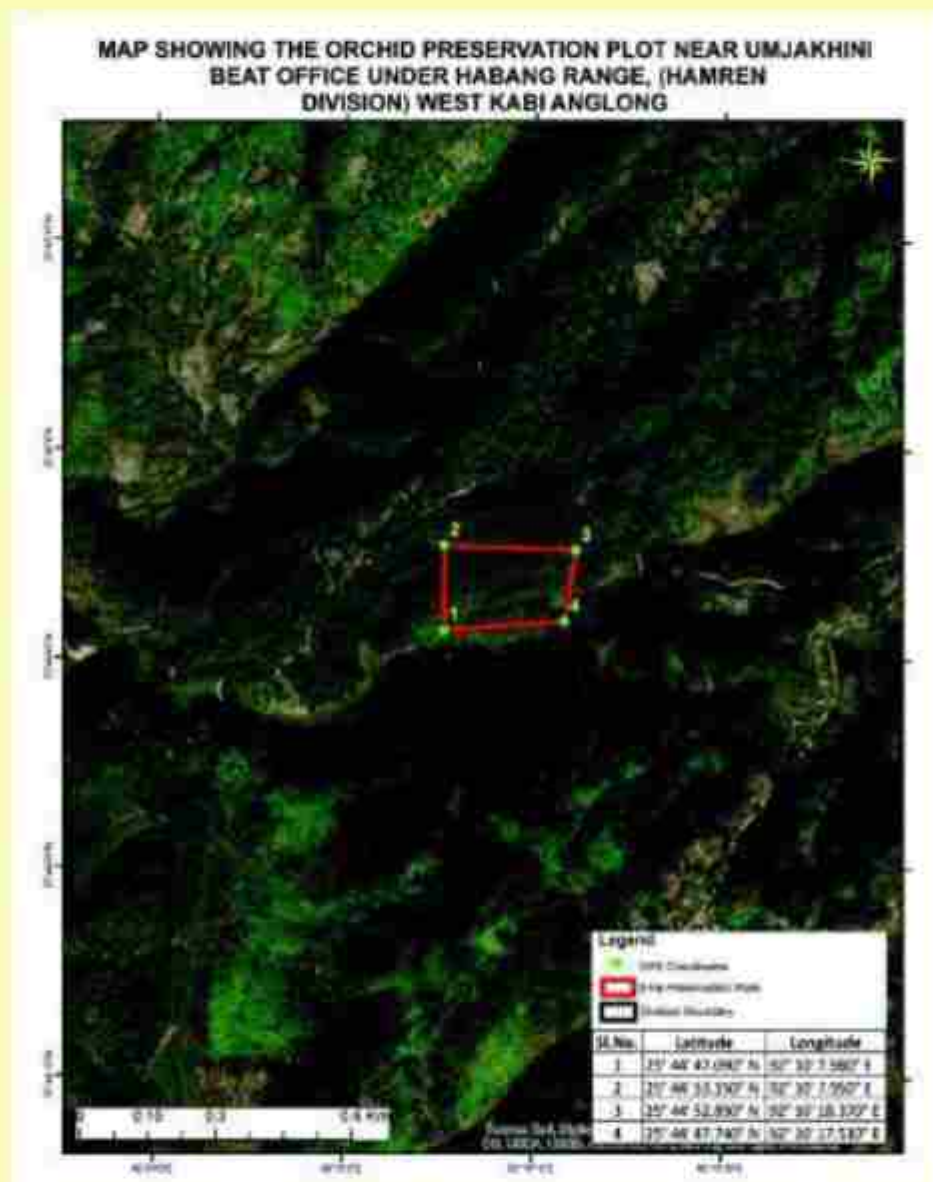
Factors essential for propagation of epiphytic orchid



7. PLOT-WISE RESEARCH FINDINGS

7.1 Plot 1. Umjakhini, West Karbi Anglong under Amsoi Silviculture Range

- 7.1.1 Location:** The plot is situated at around 130 kms by road from Guwahati via Umiam under Umjakhini Beat, Habang Range falling within Umjakhini PRF under Hamren Division, West Karbi-Anglong.



- 7.1.2 Physiography:** The plot is lying on the slopes of hillocks extended from S-SE aspect to N-NW aspect with an average slope ranging from 35% to 40%. A stream is flowing along the northern boundary of the plot.
- 7.1.3 Forest type:** The orchid study area belongs to Moist semi- evergreen forests (2BC 1/h and 2BC) and Moist mixed deciduous forests (3C/C 3b) as per Champion and Seth's Classification (Source: Working Plan of West Karbi-Anglong). The whole area is covered with many commercially important species like Badam, Gomari, Sam, Titachapa, Nahar, Bhefo, Khasia badam, Boru aam, Haldu, Bahera, Simolu, Azar, Odal, Outenga, Paroli, Makri Sal, Siris, Jamun etc.
- 7.1.4 Forest density:** The plot falls in the area where canopy density is 40-70%

7.1.5 Soil: The soil within the forest areas ranges from sandy loam to clayey loam and fine silt to red loam. The soil of the orchid plot is mostly dry red loam. But in some specific areas near the stream of the forest, the soil is quite rich in organic matter and huge deposits of humus were noticeable.

7.1.6 Date of collection of Data: From 30th Jan'2021 to 1st Feb'2021

Data collection team

- Sri Sajlen Das, AFS, Silviculturist, Assam
- Smt. Preeti Buragohain, AFS, Asst. Conservator of Forests
- Smt. Himamoni Handique, Research Officer
- Sri Ranjan Kr. Baruah, Range Officer (attached R.O. to H.Q. Silviculture Division)
- Sri Hitesh Kumar Das, Fr-1 I/c R.O. Amsoi Silviculture Range.
- Assisted by Bibhison Tokbi R.O. Umjakhini Range, Rustam Timung Fr-I along with other staffs of Umjakhini Range and labourers.

7.1.7 Data collected during field survey

7.1.7.1 Local atmospheric data

- Temperature: 27.3°C
- Humidity: 54-55%
- Soil temperature: 21.3°C (soil temperature recorded from 1 ft below the earth surface) but in the place of occurrence of Jewel orchid (*Anoectochilus roxburghii*) the temperature was found to be 15.3°C

7.1.7.2 Enumeration and marking of trees bearing orchids:

All the orchid bearing trees were marked by painting and numbering by white paint. Statement of collection of enumeration is furnished in Appendix-I.

7.1.7.3 Rehabilitation of orchids:

A total number of 5 species of wind fallen orchids were rehabilitated in living trees by tying them with coconut rope.

7.1.7.4 Procedure followed to identify epiphytic and terrestrial orchids

7.1.7.4.1 On spot identification: The morphology of the orchids was minutely observed and flowering pattern was studied in case of blooming orchids which are listed below:

Table-1 Orchids identified on-spot

Sl. No.	English Name/Local Name	Scientific name
1	Double edged dendrobium	<i>Dendrobium acinaciforme</i> Sw
2	Velvet orchid	<i>Luisia</i> sp.
3	Blue vanda	<i>Vanda coerulea</i> Griff. ex. Lindl.
4	Red vanda	<i>Renanthera imschootiana</i> Rolfe
5	Bracted pinalia	<i>Pinalia bractescens</i> (Lindl.) Kuntze
6	Bristly bulbophyllum	<i>Bulbophyllum hirtum</i> (Sm) Lindl. ex. Wall.
7	Rattlesnake orchid	<i>Pholidota imbricata</i> Hook
8	Fragrant Fox Brush Orchid	<i>Aeridis odorata</i> Lour
9	Fox tail orchid	<i>Rhynchostylis retusa</i> (L.) Blume
10	Aloe-leafed cymbidium	<i>Cymbidium pendulum</i> (Roxb) Sw
11	Fringe lipped dendrobium	<i>Dendrobium fimbriatum</i> Hook
12	Jewel orchid	<i>Anoectochilus roxburghii</i> (Wall) Lindl
13	NA	<i>Coelogyne</i> sp.

7.1.7.4.2 Off-spot identification: The blooming of the orchid flowers was monitored during the subsequent months of March and April, when orchid flower start blooming and photographs were collected for each species. Characters of the flowers from the photographs was validated with records available in publication resources and orchids available in the 3 numbers of orchid houses in the division HQ and was followed by recording the English and scientific names. The list of orchids identified off spot is enlisted below.

Table-2 Orchids identified off-spot

Sl no.	English Name/Local Name	Scientific name
1	Hooded orchid	<i>Dendrobium pierardii</i> R. Br.
2	Day's cymbidium	<i>Cymbidium dayanum</i> Rchbf
3	Nathaniel's Dendrobium	<i>Dendrobium nathanielis</i> Rchb.F
4	Reddish pholidota	<i>Pholidota rubra</i> Lindl.
5	Tropidia	<i>Tropidia</i> sp.
6	Adder's mouth	<i>Malaxis densiflora</i> (A. Rich) Kuntze

7.1.7.5 Soil sample collection: The soil samples were collected from different locations according to standard procedure as laid down in point 5.4 and were sent to District Agricultural Office, Ulubari for macro nutrient analysis of the soil.

7.1.8 Data analysis & Result

7.1.8.1 Factors attributable: The following attributes were found responsible to derive an inference on natural orchid propagation and its behaviour with relation to the existing ecosystem.

- Forest type
- Forest density
- Physiography
- Climate
- Species diversity
- Soil temperature and characteristics

7.1.8.1.1 Forest type: Since the plot falls under Moist semi- evergreen forests (2BC 1/b and 2BC) and Moist mixed deciduous forests (3C/C 3b), it is evident that it receives moderately high rainfall.

7.1.8.1.2 Forest density: The area is mostly covered with dense forest particularly on the southern aspect comprising of species of Khasia badam, Makri Sal, Odal, etc. (refer Appendix-I). On the contrary, the northern aspect of the plot is moderately dense, mostly dominated by pine and trees with deciduous character. All the epiphytes were found in the southern aspect of the plot and the terrestrial orchids were found in the northern aspect only.

7.1.8.1.3 Physiography: As most of the area of the plot is located at the south eastern aspect as a result the vegetation receives sizeable quantity of sunlight throughout the day but due to the dense canopy cover, limited amount of sunlight is penetrated through the canopy. In case of northern aspect of the plot, most of the trees are deciduous in nature resulting in the high humus formation in the forest floor and terrestrial orchids like Jewel orchids were found in abundance. Epiphytes are uncommon in that aspect of the plot. It is felt that due to less exposure to sunlight, soil temperature is found to be 7 degrees lower than the soil temperature in the southern aspect (22.5-15.3=7°C).

7.1.8.1.4 Climate:

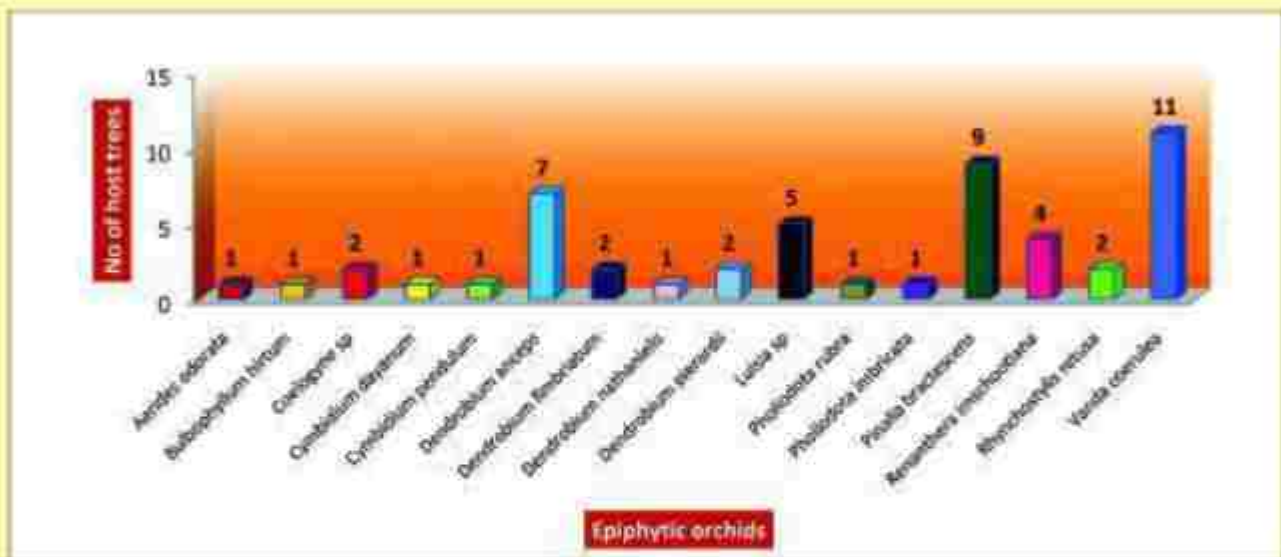
It is learnt from the local sources that this area receives very high rainfall and the annual average rainfall of West Karbi-Anglong district was found to be 2416 mm [Source: <http://westkarbianglong.assam.gov.in/>]. Hence it can be stated that the rainfall received by this particular area is pivoted towards the higher end of the annual rainfall of West Karbi-Anglong district. The annual average temperature is 6-12°C during winter and 23-32°C in summer. The winter commences from the month of October to February. It is very pertinent to note that while recording the relative humidity of the plot in the month of January, it was found that area was humid to the extent of 88% (Relative humidity) even when the area receives least amount of rainfall during that month.

7.1.8.1.5 Species diversity in epiphytic orchids:

After analyzing the raw data from Appendix I, an effort was made to establish a correlation between host trees and the epiphytic orchid species. An indicative correlation between them is furnished below:

Table 3. Epiphytic orchids with Host trees

Sl. No.	Name of epiphytic orchid species		Number of host trees associated	Host tree species
	English/Local Name	Scientific name		
1	Blue vanda	<i>Vanda coerulea</i> Griff. ex. Lindl.	11	Jamun, Khasia badam, Paroli, amlolchi, Serengpat, Odal, makri sal, Thengra, Thengsuni, Gomari, Siris
2	Bracted pinalia	<i>Pinalia bractescens</i> (Lindl.) Kuntze	9	Jamun, Serengpat, Paroli, Makri Sal, Kutahi Jamuk, Thengra, odal, Thengsuni, Siris
3	Double edged dendrobium	<i>Dendrobium acinactiforme</i> Sw.	7	Jamun, Makri sal, parole, Odal, Thengronco, Thengra, kundhuri
4	Velvet orchid	<i>Luisia</i> sp.	5	Jamun, Paroli, Thengra, Odal, Simolu
5	Red vanda	<i>Renanthera imschootiana</i> Rolfe	4	Paroli, Makri sal, Simolu, Thengra
6	Fringe lipped dendrobium	<i>Dendrobium fimbriatum</i> Hook	2	Makri sal, Odal
7	Hooded orchid	<i>Dendrobium pierardii</i> R. Br.	2	Paroli, siris
8	Fox tail orchid	<i>Rhynchostylis retusa</i> (L.) Blume	2	Khasia badam, Thengronco
9	NA	<i>Coelogyne</i> sp.	2	Makri sal, jamun
10	Nathanie's Dendrobium	<i>Dendrobium nathaniels</i> Rchb.F	1	Makri sal
11	Reddish pholidota	<i>Pholidota rubra</i> Lindl.	1	Odal
12	Rattlesnake orchid	<i>Pholidota imbricata</i> Hook	1	Makri sal
13	Fragrant Fox Brush Orchid	<i>Aeridis odorata</i> Lour	1	Odal
14	Bristly bulbophyllum	<i>Bulbophyllum hirtum</i> (Sm) Lindl. ex. Wall.	1	Khasi Pine
15	Day's cymbidium	<i>Cymbidium dayanum</i> Rchb.f	1	Khasia badam
16	Aloe-leafed cymbidium	<i>Cymbidium pendulum</i> (Roxb) Sw	1	Makri Sal



B-1. Graphical representation showing correlation of epiphytic orchids with host trees

From Table-3, narrowing down the focus on 4 nos. of epiphytic orchids which were found growing abundantly in the plot were Blue vanda (*Vanda coerulea*), Bracted pinalia (*Pinalia bractescens*), Double edged dendrobium(*Dendrobium acinaciforme*) and Velvet orchid (*Luisia sp.*). These epiphytic orchids are seen growing on various host trees ranging from minimum of 5 to maximum 11 species of host trees.

From the field observations and other publication resources, it was found that the orchids require the following specific favourable conditions for their growth: -

☛ Climate:

The growth of all the aforesaid epiphytic orchids requires some specific climatic requirements such as;

- *Vanda coerulea* grows well in warmer temperatures of 35°C during day and 15-22 °C during night time. Warmer temperatures mean faster growth which must be balanced with higher relative humidity of 80-85% from summer to autumn and 50-55% in winter to spring.
- *Dendrobium acinaciforme* also prefers warmer temperatures and requires partial shade for their growth.
- *Pinalia bractescens* also prefers warm and cool climate for its growth.

☛ Physiography:

The epiphytic orchids are mostly seen growing in the southern aspect of the plot where they receive adequate exposure to sunlight and rain and thus, they flourish.

- *Vanda coerulea* grows well at an altitude ranging from 910 to 1520 meters above MSL.
- *Dendrobium acinaciforme* are found growing in tropical and sub-tropical valleys at an elevation of 200-1400 meters above MSL.
- *Pinalia bractescens* grows at an altitude of 20-650 mts above MSL.

☛ Wind :

All the epiphytic orchids need moderate wind flow for the transportation of pollen essential for their propagation as well as air movement and ventilation during their entire growing period. This condition is satisfied when the tree height is more than 20 metres in the rainforests.

- ❖ **Host tree characteristics:** The second most important requirement for the growth of the epiphytic orchids is the characteristics of the host trees. B-1 depicts that
- *Vanda coerulea* is growing abundantly in 11 nos of host tree species.
 - *Pinalia bractescens* is growing in 9 nos of host tree species.
 - *Dendrobium acinaciforme* is growing in 7 nos. of host tree species.
 - *Luisia sp.* is growing in 5 nos. of host tree species.

It is observed that all the host tree species are mostly evergreen to semi-evergreen with little to medium sized leaves.

- ❖ **Bark characteristics:** Another most important characteristic of the host trees is the tree bark where the epiphytic orchids establish themselves. The orchids prefer rough and fissured bark where the orchid seeds lodged in the crevices more readily and grow because of the available substrate necessary for the growth of the seeds. After that as the seeds grow, the roots develop and cling to the fissures and cracks and grow profusely.

Table 4. Host trees with epiphytic orchid species

Sl. No.	Name of host tree species		Number of epiphytic orchid species associated	Epiphytic orchid species
	English/Local Name	Scientific name		
1	Makri Sal	<i>Schima wallichii</i> (DC) Korth.	9	<i>Coelogyne sp.</i> , <i>Dendrobium acinaciforme</i> , Red vanda, <i>Pholidota imbricata</i> , <i>Pinalia bractescens</i> , Blue vanda, <i>Cymbidium pendulum</i> , <i>Dendrobium fimbriatum</i>
2	Odal	<i>Sterculia colorata</i> Roxb.	7	<i>Dendrobium acinaciforme</i> , Blue vanda, <i>Aeridis odorata</i> , <i>Luisia sp.</i> , <i>Pinalia bractescens</i> , <i>Dendrobium fimbriatum</i> , <i>Pholidota rubra</i>
3	Paroli	<i>Stereospermum chelonoides</i> DC.	6	<i>Luisia sp.</i> , Blue vanda, Red vanda, <i>Pinalia bractescens</i> , <i>Dendrobium acinaciforme</i> , <i>Dendrobium pierardii</i>
4	Tbengra	NA	5	Blue vanda, <i>Pinalia bractescens</i> , <i>Luisia sp.</i> , <i>Dendrobium acinaciforme</i> , Red vanda
5	Jamun	<i>Strygium cumini</i> (L) Steels	5	<i>Coelogyne sp.</i> , <i>Dendrobium acinaciforme</i> , Blue vanda, <i>Luisia sp.</i> , <i>Pinalia bractescens</i>
6	Khasia badam	NA	3	Blue vanda, Red vanda, <i>Cymbidium dayanum</i>
7	Siris	<i>Albisia lebeckii</i> (L.) Benth	3	<i>Pinalia bractescens</i> , <i>Dendrobium pierardii</i> , Blue vanda
8	Serengpat	NA	2	<i>Pinalia bractescens</i> , Blue vanda
9	Thengronco	NA	2	<i>Dendrobium acinaciforme</i> , <i>Rhynchostylis retusa</i>
10	Thengsuni	NA	2	Blue vanda, <i>Pinalia bractescens</i>
11	Kundhuri	NA	1	<i>Dendrobium acinaciforme</i>
12	Kutahi Jamuk	<i>Strygium fruticosum</i> DC	1	<i>Pinalia bractescens</i>
13	Khasi Pine	<i>Pinus kesiya</i> Royle ex Gordon	1	<i>Bulbophyllum hirtum</i>
14	Simolu	<i>Bombax ceiba</i> L.	1	Red vanda
15	Gomari	<i>Gmelina arborea</i> Roxb.	1	Blue vanda
16	Amlakhi	<i>Phyllanthus emblica</i> L.	1	Blue vanda



B-2. Graphical representation showing correlation of host trees with epiphytic orchids

From Table-4, it is clear that 4 (four) species of host trees viz. Makri Sal (*Schima wallichii*), Odal (*Sterculla colorata*), Paroli (*Stereospermum chelonoides*) and Jamun (*Syzygium cumini*) are found to host from minimum of 5 species to maximum of 9 diverse species of epiphytic orchids out of 16 species identified, which indicates that the characteristics of the host trees are matching with the epiphytic orchids' preference for shelter. From the field study as well as other publication resources, it was found that the host trees bearing the following characteristics are suitable for harbouring epiphytic orchids.

☛ **Height of the tree:**

The height of the tree is one of the important features which affects the growth of the epiphytic orchids. The epiphytic orchids are seen growing mostly in tall trees like Makri Sal with an average height of 20 meters, Odal having an average height of 20-25 meters, Paroli with an average height of 18-20 meters and Jamun with 15-18 meters average height. The above host trees bear the maximum number of orchid species growing in those trees are mostly light demanding and the tall trees help them to fetch the adequate amount of sunlight for their growth.

☛ **Bark characteristics:**

The host trees having rough fissured bark are preferred more by the epiphytic orchids for grasping/clinging into the surface and for natural regeneration.

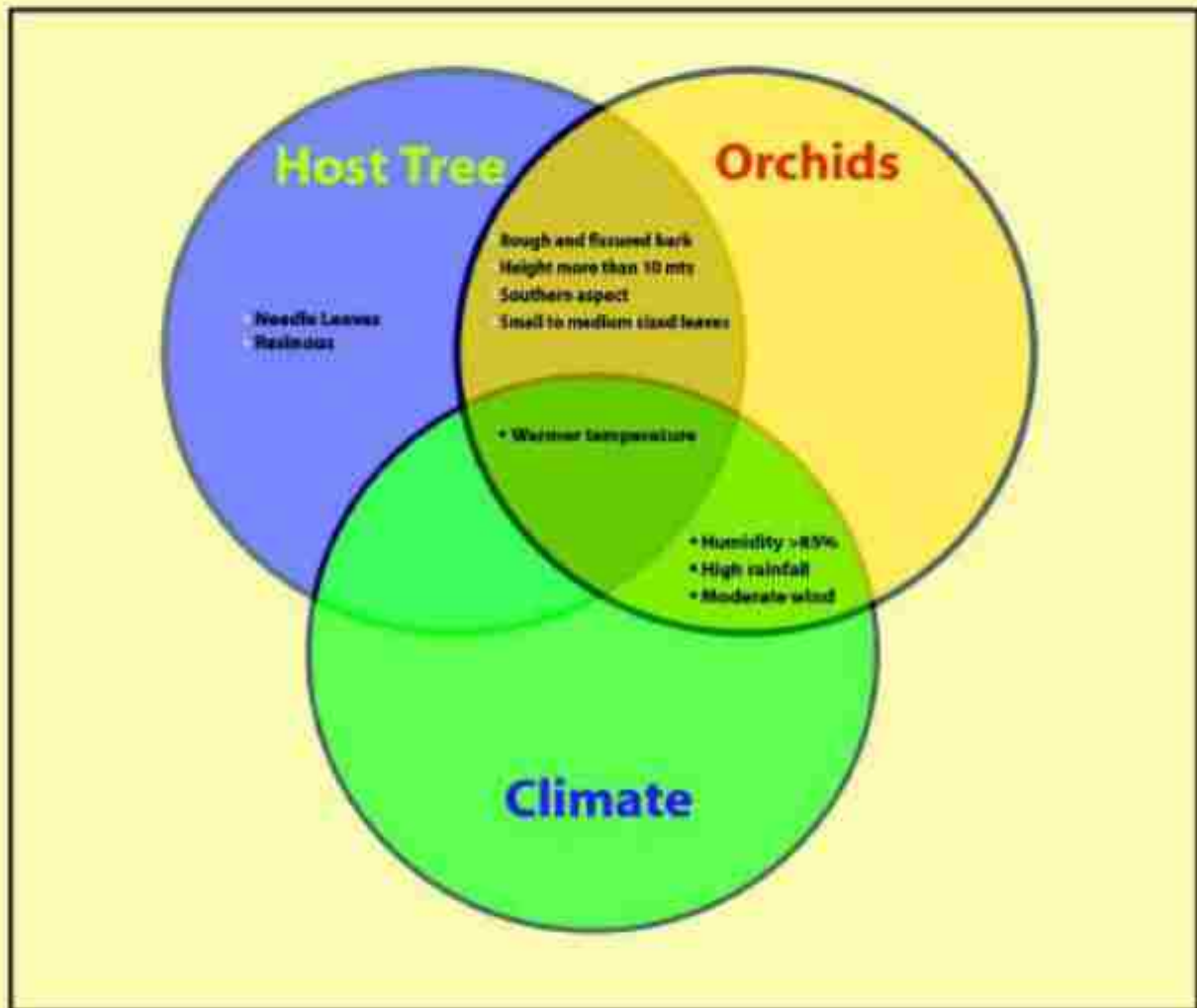
☛ **Leaf characteristics:**

The host trees bearing small to medium sized leaves are preferred more by the epiphytic orchids than trees bearing large sized leaves. The reason is that the trees having small to medium sized leaves provide partial shade to the epiphytic orchids for their growth.

From the field observations, it is noticed that the percentage of growth of epiphytic orchids in the resinous or latex producing trees is quite less. e.g., Pine though having fissured bark and needle-like leaves, is not preferred by the epiphytic orchids. Only one epiphytic orchid viz. *Bulbophyllum hirtum* was seen growing in it.

Rest of the epiphytic orchids and host trees have a lesser affinity towards each other due to reduced matching with respect to preference of the epiphytic orchids and the characteristics of the host trees. It may be inferred that there is a direct and indirect correlation among

(a) climate;
 (b) topography;
 (c) characteristics of host trees; and
 (d) sustenance of epiphytic orchids-
 in a particular ecosystem. The indicator of this complex dynamics can be observed in the plot where there is a localized development of humid micro climate due to transpiration of moisture by host trees as well as epiphytic orchids.



V-1. Venn diagram showing epiphytic orchid and host tree relationship dynamics

7.1.8.1.6 Species diversity

in terrestrial orchids: The following attributes played a major role in the species diversity of terrestrial orchids:

☛ **Topography:**

The terrestrial orchids were seen growing in the northern aspect of the plot where it receives lesser number of sunrays obliquely subsequently reducing the temperature of the soil. A micro climate which has developed in the northern aspect due to the stream makes the plot suitable for the growth of the terrestrial orchids.

☛ **Vegetation:**

The trees growing in the northern aspect are of deciduous character which results in high humus formation in the forest floor. Since the moisture

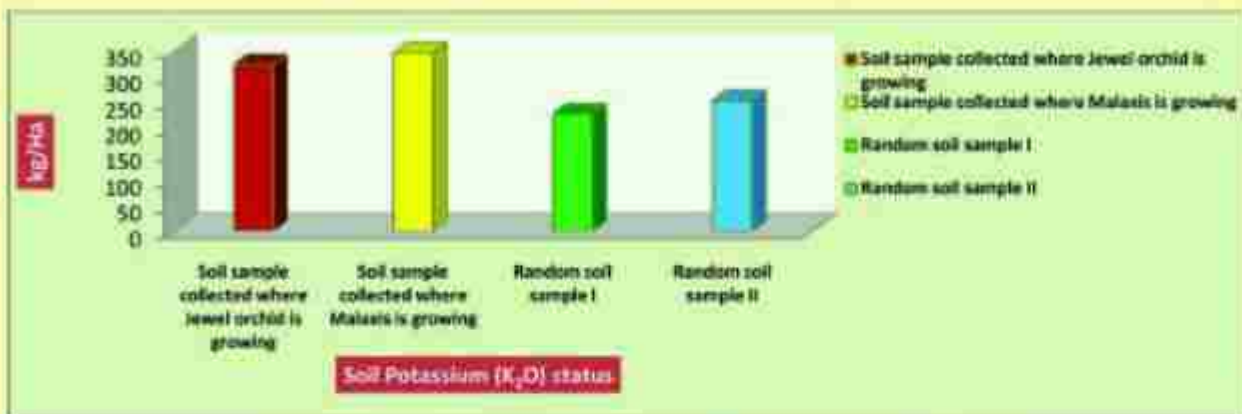
content in the air is high due to the presence of the stream nearby, degradation of litter is enhanced subsequently accelerating the process of humus formation. Another important observation was that there was a substantial growth of bushy shrubs, alocasia species which further obstructs the penetration of sunlight to the ground resulting in lowering down of atmospheric temperature and making the area more suitable for the growth of terrestrial orchids like Jewel orchid.

Soil:

Another important parameter is the soil for the growth of the terrestrial orchids. The terrestrial orchid species usually prefer soil of acidic pH which is evident from the soil collected from the place of occurrence of terrestrial orchid species. The pH of the soil ranges from 3.82-4.67 which is extremely acidic compared to soil collected from other parts of the plot. After the macronutrient analysis of the soil collected from the areas where terrestrial orchids were found, it is observed that the terrestrial orchids prefer soil with high organic carbon content, low phosphorus and medium to high potassium content.



B-3. Graphical representation of Soil Nutrient Status



B-4. Graphical representation of Soil Potassium (K₂O) Status

Three species of terrestrial orchids viz. Jewel Orchid (*Anoectochilus roxburghii*), *Malaxis densiflora* and *Tropidia sp.* were found in the plot. Jewel orchid (*Anoectochilus roxburghii*) is one of the endangered terrestrial orchid species which is found in this plot. This orchid species is found growing in the areas with high humus formation in the soil. The soil temperature recorded in the place of occurrence of Jewel orchids is 15.3°C which is 7°C (approx.) lower than the normal soil temperature recorded in other parts of the plot. The Jewel orchid (*Anoectochilus roxburghii*) prefers soil having pH 3.82 which is extremely acidic in nature. As it prefers soil

with high humus content, the soil organic carbon was found to be 6.35%. The phosphorus content of the soil was found to be 4.014 kg/ha which is very low and the potassium content was found to be 321.62 kg/ha. The Jewel orchid species was seen growing as lithophytes near the stream where there is accumulation of humus in the rocks.

Malaxis densiflora and *Tropidia* sp. were also found in the areas which receive less sunlight and are rich in high humus content.



Jewel orchid [*Anoectochilus roxburghii* (Wall) Lindl]



Jewel orchids [*Anoectochilus roxburghii*] occurring as lithophytes



Tropidia sp.



Malaxis densiflora

7.1.9 Statistical analysis :

Statistical analysis of the data obtained was carried out to determine the statistical significance of data, richness of biodiversity and extent of biodiversity with respect to epiphytic orchids and host trees. Here p value, Shannon-Weiner Diversity index and Biodiversity analysis were calculated using MS-Excel. The details of the result is shown below :

Table I(1)

OBSERVED VALUE (UM)AKINI PLOT)	Jaman	Khaasia Badam	Paroli	Makri Sal	Pine	Amlukhi	Serenipat	Simala	Odai	Horu Jansuk	Thengrocco	Thengra	Thengruul	Ganart	Siris	Kumbhari	TOTAL
<i>Caelogyne spp</i>	1	0	0	4	0	0	0	0	0	0	0	0	0	0	0	0	5
<i>Dendrobium anceps</i>	1	0	2	10	0	0	0	0	1	0	1	1	0	0	0	1	17
<i>Lulisa spp</i>	1	0	1	0	0	0	0	1	1	0	0	1	0	0	0	0	5
<i>Pinalia brachitescens</i>	1	0	2	4	0	0	1	0	2	1	0	1	1	0	1	0	14
<i>Vanda coerulea</i>	2	2	3	11	0	1	1	0	1	0	0	1	1	1	1	0	25
<i>Renanthera imschootiana</i>	0	0	4	5	0	0	0	1	0	0	0	1	0	0	0	0	11
<i>Dendrobium pierardii</i>	0	0	1	0	0	0	0	0	0	0	0	0	0	0	1	0	2
<i>Cymbidium dayanum</i>	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
<i>Bulbophyllum hirtum</i>	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	1
<i>Rhynchostylis retusa</i>	0	1	0	0	0	0	0	0	0	1	0	0	0	0	0	0	2
<i>Dendrobium nathanielis</i>	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	1
<i>Dendrobium fimbriatum</i>	0	0	0	1	0	0	0	0	1	0	0	0	0	0	0	0	2
<i>Cymbidium pendulum</i>	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	1
<i>Pholidota rubra</i>	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	1
<i>Aerides odorata</i>	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	1
<i>Pholidota imbricata</i>	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	2
TOTAL	6	4	13	39	1	1	2	2	8	1	2	5	2	1	3	1	91

Total number of observations = 91

Table I(2)

p0	lnp0	p0*lnp0	H	Hmax	ORCHID EQUITABILITY
0.05	-2.90	-0.16	2.16	2.77	0.78
0.19	-1.68	-0.31			
0.05	-2.90	-0.16			
0.15	-1.87	-0.29			
0.27	-1.29	-0.35			
0.12	-2.11	-0.26			
0.02	-3.82	-0.08			
0.01	-4.51	-0.05			
0.01	-4.51	-0.05			
0.02	-3.82	-0.08			
0.01	-4.51	-0.05			
0.02	-3.82	-0.08			
0.01	-4.51	-0.05			
0.01	-4.51	-0.05			
0.02	-3.82	-0.08			

Orchid equitability = 0.78

Table I(3)

N*(N-1) (Orchids)	n*(n-1)	ORCHID BIODIVERSITY
8190	20	6.76
	272	
	20	
	182	
	600	
	110	
	2	
	0	
	0	
	2	
	0	
	2	
	0	
	0	
	2	
1212		

Orchid biodiversity = 6.76

Table I(4)

pHT	lnpHT	pHT*lnpHT	H	Hmax	HOST TREE EQUITABILITY
0.07	-2.72	-0.18	2.03	2.77	0.73
0.04	-3.12	-0.14			
0.14	-1.95	-0.28			
0.43	-0.85	-0.36			
0.01	-4.51	-0.05			
0.01	-4.51	-0.05			
0.02	-3.82	-0.08			
0.02	-3.82	-0.08			
0.09	-2.43	-0.21			
0.01	-4.51	-0.05			
0.02	-3.82	-0.08			
0.05	-2.90	-0.16			
0.02	-3.82	-0.08			
0.01	-4.51	-0.05			
0.03	-3.41	-0.11			
0.01	-4.51	-0.05			

Host tree equitability = 0.73

Table I(5)

N*(N-1) (Host Trees)	n*(n-1)	HOST TREE BIODIVERSITY
8190	30	4.63
	12	
	156	
	1482	
	0	
	0	
	2	
	2	
	56	
	0	
	2	
	20	
	2	
	0	
	6	
0		
1770		

Host tree biodiversity = 4.63

Table I(6)

t-Test: Two-Sample Assuming Unequal Variances	ORCHID	HOST TREE
Mean	6	6
Variance	56.07	89.56
Observations	15	16
df	28	
t Stat	-3.26	
P(T<=t) one-tail	0.0015	
t Critical one-tail	1.70	
P(T<=t) two-tail	0.0029	
t Critical two-tail	2.05	

p value (one tailed) = 0.0015

p value (two tailed) = 0.0029

From the Tables I (2) and I(3), it is clear that the epiphytic orchid diversity in Umjakhini study plot is moderate, showing a value of 6.76 and their evenness/richness is also on a higher side i.e. 0.78. In case of host tree biodiversity, this plot shows less diversity of 4.63 and a higher equitability value of 0.73 which is clearly shown in Tables I(4) and Table I(5). In respect to statistical significance, Table I(6) shows that the p value for both one tailed and two tailed lies below 0.05 which means that the data collected are statistically significant.

Photographs of orchids collected from Umjakhini Study Plot



Bulbophyllum hirtum

Cymbidium dayanum plant

Cymbidium dayanum



Blue vanda plant

Vanda coerulea

Renanthera imschootiana



Pholidota rubra



Rhynchostylis retusa



Orchid Cluster



Dendrobium fimbriatum



Dendrobium pierardii



Aerides odorata



Pinalla bractescens

7.2 Plot No. 2, Jeypore RF, Dibrugarh Division under Jeypore Silviculture Range

7.2.1 Location:

The plot is situated at around 485 kms (approx.) by road from Guwahati under Kothalgari Beat, Jeypore Territorial Range falling within Jeypore RF under Dibrugarh Division.



7.2.2 Physiography:

The plot is lying on the slopes of hillocks with an average ESE aspect and average slope ranging from 30% to 45%.

7.2.3 Forest type:

The orchid study area belongs to Assam Valley Tropical Wet Evergreen Forests (*Dipterocarpus*) (Type IB/CI) as per Champion and Seth's revised Classification. The forest type occurring in the area is mostly Hollong-Nahor forests which are characterized by large tall evergreen trees forming the bulk of the main canopy projecting above the general level.

- **1st Canopy layer:** This comprises of magnificent luxuriant growth of *Dipterocarpus retusus* (Hollong) trees. Ecologically it is known as climatic climax species of this region. *Michelia champaca* (Tiasopa), *Ailanthus excelsa* (Borpat) etc. are found as its associates.

- **2nd Canopy layer:** This layer mainly consists of *Mesua ferrea* (Nahor) with *Artocarpus chaplasi*, *Amoora wallichii*, *Amoora rohitoka*, *Anthocephalus kadamba*, *Terminalia tomentosa*, *Terminalia myriocarpa*, *Terminalia belerica*, *Dysoxylum procerum*, *Tolauma hodgsoni*, *Trewia nudiflora*, *Chukrassia tabularis*, *Morus laevigata*, *Eugenia* species and many other common species.
- **3rd Canopy layer:** It is mainly dominated by *Vatica lanceaefolia* (Morhal), *Lagerstroemia speciosa* (Ajar), *Albizia lucida* (Ma), *Dillenia indica* (Owtenga), *Dillenia scabreua* (Bajiw) etc.

Shrub growth: It consists of mainly woody shrubs like Kaupat, Jora, Bogitora, etc. Palms like Geregu tamul, Tokopat, tree ferns, canes, woody climbers like *Derris oblonga*, *Tapiria hirsute*, *Mazonerurum cueuilatum*, *Entoda scanders*, *Thumbergia* spp. *Bauhinia vahlii*, etc. are more common.

- **Ground Flora:** Various herbs and small shrubs like Bon posola, Dhopat tita, Digholoti, Surat, Heloch, Kasidoria, Patidol, Ferns, etc. and grasses like Ekora, Meghela, Elephant grass, *Mimosa pudica* etc. are the most common flora comprising ground layer.

(Source: Working Plan of Digboi and Dibrugarh Division).

7.2.4 Forest density:

The plot falls in the area where canopy density is 60-80%

7.2.5 Soil:

Soils of the area are sandy to clayey loam type and greyish in color. They are acidic in reaction with pH ranging from 4.6 to 5.9. They are also characterized by low to medium phosphate and medium to high potash content. A substantial amount of humus formation has been observed in the plot which might have formed due to the degradation of the shrubs and ground flora.

(Source: Working Plan of Dibrugarh Division).

7.2.6 Date of collection of Data: From 27th Feb'2021 to 1st March'2021

Data collection team

- Sri Sailen Das, AFS, Silviculturist, Assam
- Smt. Preeti Buragohain, Asstt. Conservator of Forests
- Smt. Himamoni Handique, Research Officer
- Sri Pranjali Prakash Das, Fr-I I/c R.O. Jeypore Silviculture Range.
- Sri Himangshu Bhattacharjee Fr-I, Jeypore Silviculture Range.
- Assisted by Sri Sarat Neog, R.O. Jeypore Range along with other staffs of Jeypore Range and labourers. Special mention to Sri Lakhindar Sonowal, an experienced NGO field staff who helped in identification of some orchids of Jeypore RF.

7.2.7. Data collected during field survey

7.2.7.1. Local atmospheric data

- Temperature: 22°C- 24°C
- Humidity: 86-88%
- Average soil temperature: 21.1°C-21.3°C (soil temperature recorded from 1 ft below the earth surface)

7.2.7.2 Enumeration and marking of trees bearing orchids:

All the orchid bearing trees were marked by painting and numbering by white paint. Statement of collection of enumeration is furnished in Appendix-II.

7.2.7.3 Rehabilitation of orchids: A total number of 3 species of wind fallen orchids were rehabilitated in living trees by tying them with coconut rope.

7.2.7.4 Procedure followed to identify epiphytic and terrestrial orchids

7.2.7.4.1 On spot identification: The morphology of the orchids was minutely observed and flowering pattern was studied in case of blooming orchids which are listed below:

Table-5 Orchids identified on-spot

Sl. No.	English Name/Local Name	Scientific name
1	Fox tail orchid	<i>Rhynchostylis retusa</i> (L) Blume
2	Rattlesnake orchid	<i>Pholidota imbricata</i> Hook
3	Carey's Bulb-leaf Orchid	<i>Bulbophyllum careyanum</i> (Hook) Spreng
4	Flat Stemmed Agrostophyllum	<i>Agrostophyllum planicaule</i> (Wall. Ex Lindl)
5	Red Fox Orchid	<i>Bulbophyllum sikkimense</i> (King & Pantl)
6	Hooded orchid	<i>Dendrobium aphyllum</i> (Roxb) C.E.C. Fisch
7	Aloe-leafed cymbidium	<i>Cymbidium aloifolium</i> (L) Sw.
8	The Awl-shaped Cleisostoma	<i>Cleisostma subulatum</i> Bl. Bijdr
9	Striped Star Orchid	<i>Bulbophyllum affine</i> Lindl. Gen
10	Jewel orchid	<i>Anoectochilus roxburghii</i> (Wall) Lindl
11	The Forest dwelling calanthe	<i>Calanthe masuco</i> (D.Don)Lindl.
12	The Nerved Zeuxine	<i>Zeuxine nervosa</i> (Wall. Ex Lindl) Benth
13	The Mishmi Hills Phaius	<i>Phaius mishmensis</i> (Lind & Paxt)Rchb.f
14	Nun's Orchid/Kunai (tall grass) orchid	<i>Phaius tankervilleae</i> (Banks ex Herit) Bl
15	The Musky Smelling dendrobium	<i>Dendrobium moschatum</i> (Buch-Ham)Sw.
16	Fragrant Fox Brush Orchid	<i>Aerides odorata</i> Lour
17	The Sylhet Acanthephippium	<i>Acanthephippium sylhetense</i> Lindl.
18	The Shaggy Petaled Eria	<i>Eria lasiopetala</i> Willd.

7.2.7.4.2 Off-spot identification: The blooming of the orchid flowers was monitored during the subsequent months of April to July , when orchid flower start blooming and photographs were collected for each species. Characters of the flowers from the photographs was validated with records available in publication resources and orchids available in the 3 numbers of orchid houses in the division HQ and was followed by recording the English and scientific names. The list of orchids identified off spot is enlisted below.

Table-6 Orchids identified off-spot

Sl no.	English Name/Local Name	Scientific name
1	Bent-racemed dendrobium	<i>Dendrobium lituiflorum</i> Lindley
2	The Broad Leafed Tainia	<i>Tainia latifolia</i> (Lindl.)Rchb
3	Wray's Tainia	<i>Tainia wrayana</i> (Hook.f)
4	Roxburgh's Bulbophyllum	<i>Bulbophyllum roxburghii</i> (Lindl) Rchb.
5	The Lute-shaped Lip Calanthe	<i>Calanthe lyroglossa</i> Rchb.f
6	The Dense beard gastrochilus	<i>Gastrochilus dasypogon</i> (J.E.Sm.) Kuntze

7.2.7.5 Soil sample collection: The soil samples were collected from different locations according to standard procedure as laid down in point 5.4 and were sent to District Agricultural Office, Ulubari for macro nutrient analysis of the soil.

7.2.8. Data analysis & Result

7.2.8.1 Factors attributable: The following attributes were found responsible to derive an inference on natural orchid propagation and its behavior with relation to the existing ecosystem.

- **Forest type**
- **Forest density**
- **Physiography**
- **Climate**
- **Species diversity**
- **Soil temperature and characteristics**

7.2.8.1.1 Forest type: Since the plot falls under Assam Valley Tropical Wet Evergreen Forests (Dipterocarpus) (Type IB/CI), high humidity and high rainfall are its characteristic features.

7.2.8.1.2 Forest density: The area is mostly covered with dense forest all throughout except some open patches (approx. 1 Ha). The plot mostly comprised of species of Hollong, Nahor, Morhal, Borpat, Mekai, Lewa, etc. (refer Appendix-II). Climbers, epiphytes, palms and canes are also present. The plot is also very rich in terrestrial orchids.

7.2.8.1.3 Physiography: The plot is covered by a number of hillocks with an average altitude of 10-12 metres (approx.) and the distribution of epiphytic and terrestrial orchid species is almost uniform throughout the plot. Therefore, physiography doesn't have any impact on the species distribution of orchids.

7.2.8.1.4 Climate: The study area experiences sub-tropical humid climate and falls under high humid zone as the plot lies between the latitudes of 23-35°C Northern Hemisphere. Fig 2 represents the monthly min, max, and average temperature in the area from 2009 and 2019. The hottest months are May, June, July and August and the coldest months are December and January. The area is endowed with high rainfall. Maximum precipitation occurs between the months of April and September. Fig 3 shows the average monthly rainfall between 2009 and 2019.

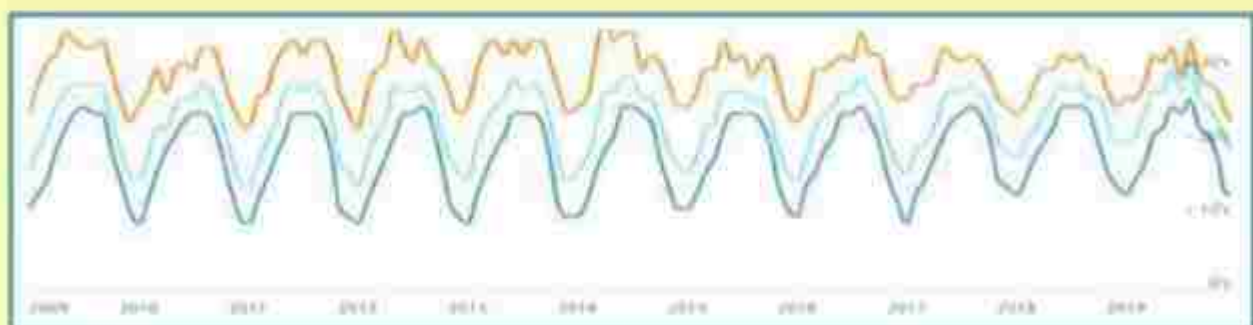


Fig 2: Monthly max, min. and avg. temperature (°C) from 2009 to 2019



Fig 3: Monthly mean rainfall (mm) from 2009 to 2019

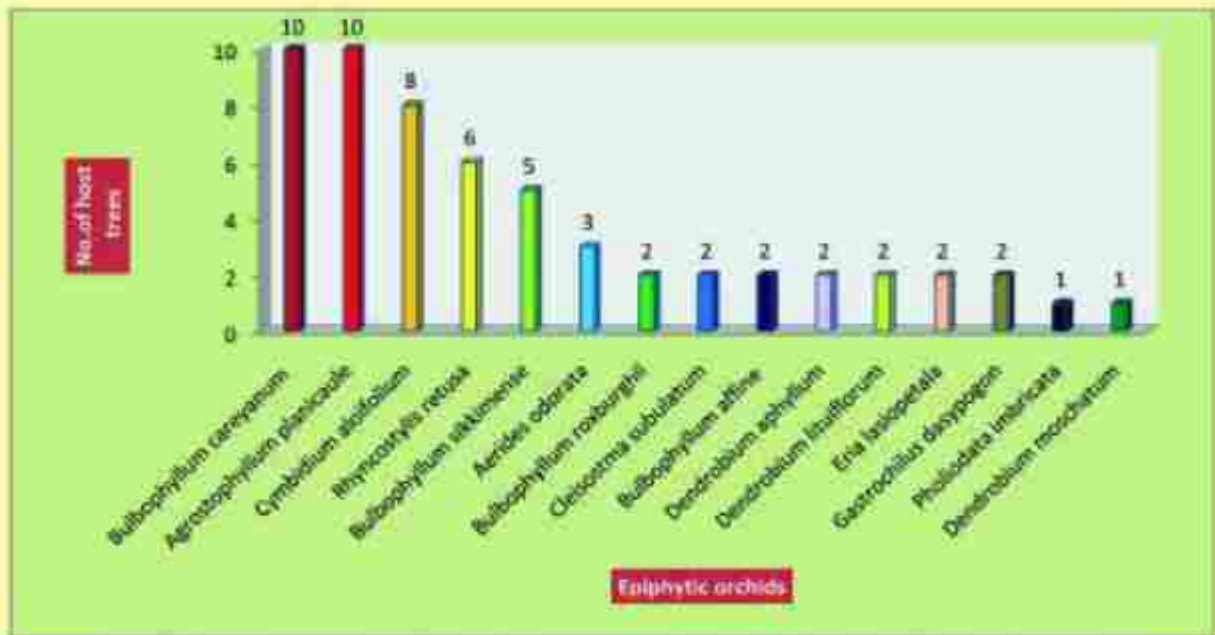
(Source: Working Plan of Dibrugarh Division)

7.2.8.1.5 Species diversity

in epiphytic orchids: After analyzing the raw data from Appendix II, an effort was made to establish a correlation between host trees and the epiphytic orchid species. An indicative correlation between them is furnished below:

Table 7. Epiphytic orchids with Host trees

Sl. No.	Name of epiphytic orchid species		Number of host trees associated	Host tree species
	English/Local Name	Scientific name		
1	Carey's Bulb-leaf Orchid	<i>Bulbophyllum careyanum</i> (Hook) Spreng	10	Nahar, Morhal, Hollong, Hingori
2	Flat Stemmed Agrostophyllum	<i>Agrostophyllum planicaule</i> (Wall. Ex Lindl)	10	Nahar, Morhal, Hollong, Mekai, Hingori
3	Aloe-leafed cymbidium	<i>Cymbidium aloifolium</i> (L.) Sw.	8	Panimoti, Mekai, Barpat, Hollong, Jagaru, Ghila Iota (Climber)
4	Fox tail orchid	<i>Rhynchosstylis retusa</i> (L.) Blume	5	Morhal, Barpat, Hollong, Jagaru
5	Red Fox Orchid	<i>Bulbophyllum sikkimense</i> (King & Pantl)	5	Hollong, Dimoru, Ghila Iota (Climber)
6	Fragrant Fox Brush Orchid	<i>Aerides odorata</i> Lour	3	Leteku, Hollong
7	Roxburgh's Bulbophyllum	<i>Bulbophyllum roxburghii</i> (Lindl) Rchb.	2	Hollong
8	The Awl-shaped Cleistostoma	<i>Cleistostoma subulatum</i> Bl. Bijdr	2	Nahar, Hollong
9	Striped Star Orchid	<i>Bulbophyllum affine</i> Lindl. Gen	2	Hollong
10	Hooded orchid	<i>Dendrobium aphyllum</i> (Roch) C.E.C. Fisch	2	Hollong
11	Bent-racemed dendrobium	<i>Dendrobium lituiflorum</i> Lindley	2	Hollong
12	The Shaggy Petaled Eria	<i>Eria lasiopetala</i> Willd.	2	Morhal, Mekai
13	The Dense beard gastrochilus	<i>Gastrochilus dasypogon</i> (J.E.Sm.) Kuntze	2	Leteku, Lewa
14	Rattlesnake orchid	<i>Phaiuslota imbricata</i> Hook	1	Barpat
15	The Musky Smelling dendrobium	<i>Dendrobium moschatum</i> (Buch-Ham) Sw.	1	Hollong



B-5. Graphical representation showing correlation of epiphytic orchids with host trees

Table 7 depicts the abundance of different types of epiphytic orchids in the plot out of which 5 (five) species of epiphytic orchids viz. Carey's Bulb-leaf Orchid (*Bulbophyllum careyanum*), Flat Stemmed Agrostophyllum (*Agrostophyllum planicaule*), Aloe-leaved cymbidium (*Cymbidium aloifolium*), Fox tail orchid (*Rhynchostylis retusa*) and Red Fox Orchid (*Bulbophyllum sikkimense*) are seen growing on various host trees ranging from minimum of 5 to maximum of 10 species.

From field study and other publication resources, it was found that the following factors might have triggered the growth of the epiphytic orchids in the plot: -

Climate:

As per study and field observations, it may be stated that the growth of all the aforesaid epiphytic orchids require some specific climatic requirements such as;

- *Bulbophyllum* species are most common in these forests. 4 (four) species of *Bulbophyllum* were recorded in the study area viz. *Bulbophyllum careyanum*, *Bulbophyllum sikkimense*, *Bulbophyllum roxburghii* and *Bulbophyllum affine*. After going through different publication resources, it is found that the *Bulbophyllum* species usually grow in the rainforests. They prefer temperature of 12-25 °C and 60% Relative Humidity for their growth. Since the plot falls in the Assam Valley Tropical Wet Evergreen Forests (Dipterocarpus) (Type IB/CI), the climatic conditions are most favourable for the growth of *Bulbophyllum* species of epiphytic orchids.
- *Agrostophyllum planicaule* grows well in moist forests at an altitude ranging from 500-2100 mts above MSL.
- *Cymbidium aloifolium* also require warm and humid climate in their growing period i.e. 20-24 °C and cool climate in flowering seasons i.e. 10-20°C. They prefer light shade from the midday sun and relative humidity of 50-80%.
- *Rhynchostylis retusa* is also seen growing abundantly in the plot. This epiphytic orchid also prefers a humid atmosphere for its growth. This belt is also rich in different species of *Rhynchostylis* viz. *Rhynchostylis retusa* var. *alba* and *Rhynchostylis gigantea*. It is pertinent to mention that during

the reconnaissance survey, *Rhynchostylis retusa* were seen in abundance but during the study period, very limited numbers were observed. Biotic interference might be the reason of its depletion.

❖ **Wind :**

All the epiphytic orchids need moderate wind flow for the Transportation of pollen essential for their propagation as well as air movement and ventilation during their entire growing period. This condition is satisfied when the tree height is more than 20 metres in the rainforests.

❖ **Host tree characteristics:**

The second most important requirement for the growth of the epiphytic orchids is the characteristics of the host trees. B-5 depicts that

- *Bulbophyllum careyanum* and *Agrostophyllum planicaule* are growing abundantly in 10 nos of host tree species.
- *Cymbidium aloifolium* is growing in 8 nos of host tree species.
- *Rhynchostylis retusa* is growing in 5 nos. of host tree species.
- *Bulbophyllum sikkimense* is growing in 5 nos. of host tree species.

It is observed that all the host tree species are mostly evergreen to semi-evergreen with little to medium sized leaves.

❖ **Bark characteristics:**

Another most important characteristic of the host trees is the fissured bark/rough bark surface where the epiphytic orchids establish themselves. In this plot, the bark of the host trees is smooth with less fissures but due to the humid climate prevailing throughout the year, barks are moderately covered by the growth of lichens and mosses contributing to roughness of the bark and this might have helped in the establishment and growth of the epiphytic orchids in the trees.

Table 8. Host trees with epiphytic orchid species

Sl. No.	Name of host tree species		Number of epiphytic orchid species associated	Epiphytic orchid species
	English/Local Name	Scientific name		
1	Hollong	<i>Dipterocarpus retusus</i> Blume	12	<i>Agrostophyllum planicaule</i> , <i>Aerides odorata</i> , <i>Dendrobium aphyllum</i> , <i>Bulbophyllum roxburghii</i> , <i>Dendrobium lituiflorum</i> , <i>Bulbophyllum careyanum</i> , <i>Dendrobium moschatum</i> , <i>Bulbophyllum affine</i> , <i>Bulbophyllum sikkimensis</i> , <i>Cymbidium aloifolium</i> , <i>Rhynchostylis retusa</i> , <i>Cleistanoma subulatum</i> .
2	Morhal	<i>Vatica lanceaefolia</i> Blume	4	<i>Agrostophyllum planicaule</i> , <i>Rhynchostylis retusa</i> , <i>Bulbophyllum careyanum</i> , <i>Eria lasiopetala</i> .
3	Mekai	<i>Shorea assamica</i> Dyer	3	<i>Cymbidium aloifolium</i> , <i>Cymbidium aloifolium</i> , <i>Eria lasiopetala</i>
4	Nahar	<i>Mesua ferrea</i> L.	3	<i>Bulbophyllum careyanum</i> , <i>Cleistanoma subulatum</i> , <i>Agrostophyllum planicaule</i>
5	Barpat	<i>Ailanthus grandis</i> Prain	2	<i>Cymbidium aloifolium</i> , <i>Pholidota imbricata</i>
6	Ghila lota (Climber)	<i>Entada pursoetha</i> DC	2	<i>Bulbophyllum sikkimensis</i> , <i>Cymbidium aloifolium</i>
7	Hingori	<i>Castanopsis indica</i> (Roxb. Ex. Lindl) A.DC.	2	<i>Bulbophyllum careyanum</i> , <i>Agrostophyllum planicaule</i>

8	Jagaru	<i>Macaranga denticulata</i> (Bl) Muell-Arg	2	<i>Cymbidium aloifolium</i> , <i>Rhynchostylis retusa</i>
9	Leteku	<i>Baccaurea rapida</i> (Roxb.) Müll-Arg	2	<i>Gastrochilus dasypogon</i> , <i>Aerides odorata</i> .
10	Lewa	<i>Engelhardtia spicata</i>	1	<i>Gastrochilus dasypogon</i>
11	Dimoru	<i>Ficus hispida</i> L. f.	1	<i>Bulbophyllum sikkimensis</i>
12	Panimudi	<i>Glochidion arborescens</i> Bl.	1	<i>Cymbidium aloifolium</i>



B-6. Graphical representation showing correlation of host trees with epiphytic orchids

From Table 8, it is evident that 4 (four) species of host trees viz. Hollong, Morhal, Mekai and Nahor are found to host diverse species of epiphytic orchids out of which Hollong is seen to host a maximum of 12 species of epiphytic orchids. Morhal, Mekai and Nahor are seen to host 3-4 species of epiphytic orchids. From the field study as well as other publication resources, it was found that the trees in the rainforests bear the following characteristics which makes them suitable for harbouring different species of epiphytic orchids.

☛ **Height of the tree:**

The height of the tree is one of the important features which affects the growth of the epiphytic orchids. Hollong (*Dipterocarpus retusus*) forming the 1st canopy of the rainforests is observed to host the maximum number of epiphytic orchid species followed by Morhal, Mekai and Nahor which forms the 2nd and 3rd canopy respectively. As the Hollong tree is the tallest of all, adequate quantity of sunlight is received by the epiphytic orchids which favours their growth in these trees.

☛ **Bark characteristics:**

In this plot, the bark of the host trees bearing the epiphytic orchids is mostly smooth. It is presumed that diminished exfoliation of the bark have resulted in reduced shedding and thus greater persistence of epiphytes. Moreover, due to the humid climate prevailing almost all round the year, lichens and mosses are seen growing in the tree trunks. In the field, it is also observed that the epiphytic orchids are growing in the patches of the tree trunks where lichens and mosses are seen. It is presumed that the growth of lichens and mosses in the tree trunks creates uneven surface which suffices the growth of the epiphytic orchids. In addition, lichens and mosses provide sufficient moisture intake which helps in the growth of epiphytic orchids profusely.



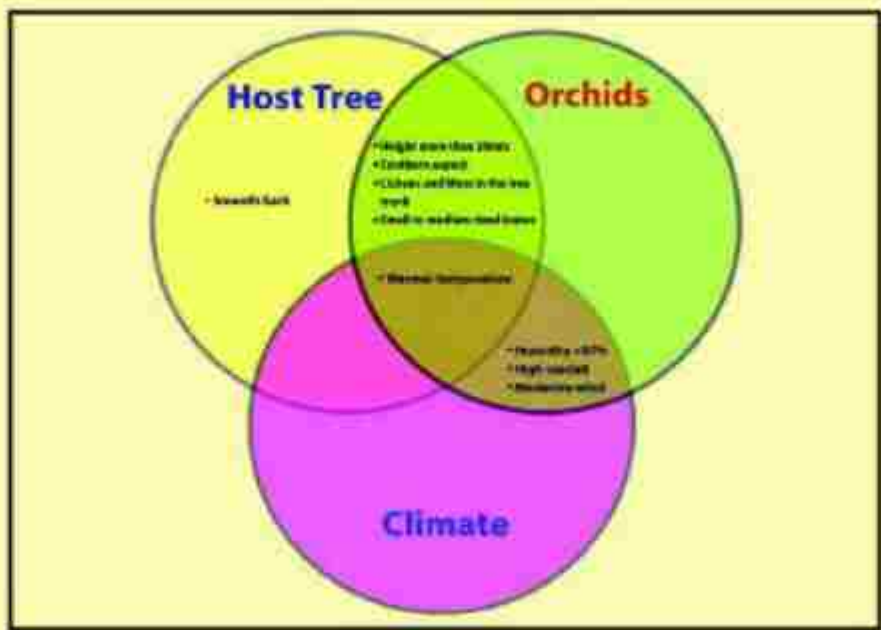
Tree trunks with lichens & mosses facilitating orchid growth

❶ **Leaf characteristics:** The host tree species bearing the epiphytic orchids are mostly evergreen. Therefore, the trees provide partial shade to the epiphytic orchids during their entire growth period.

Rest of the epiphytic orchids and host trees have a lesser affinity towards each other due to reduced matching with respect to preference of the epiphytic orchids and the characteristics of the host trees. It may be inferred that there is a direct and indirect correlation among

- (a) climate;
- (b) wind;
- (c) characteristics of host trees; and
- (d) sustenance of epiphytic orchids-

in this particular ecosystem. The indicator of this complex dynamics can be observed in the plot where there is a localized development of humid micro climate due to transpiration of moisture by host trees as well as epiphytic orchids.



V-2. Venn diagram showing epiphytic orchid and host tree relationship dynamics

7.2.8.1.6 Species diversity in

terrestrial orchids:

The whole plot is very rich in variety of terrestrial orchids. A total of 9 species of terrestrial orchids were recorded from the study area out of which the status of 3 (three) species viz. *Calanthe lyroglossa*, *Anoectochilus roxburghii* and *Tainia wayana* are rare and endangered.

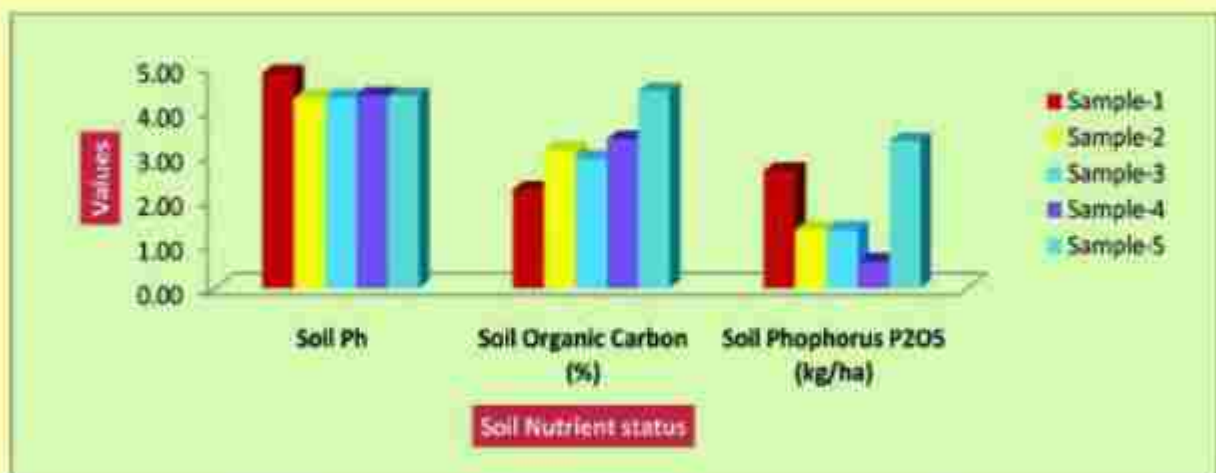
From the field study as well as secondary publication sources, it is found that the following factors have favoured the growth of terrestrial orchids in this particular area :

☛ Climate and vegetation :

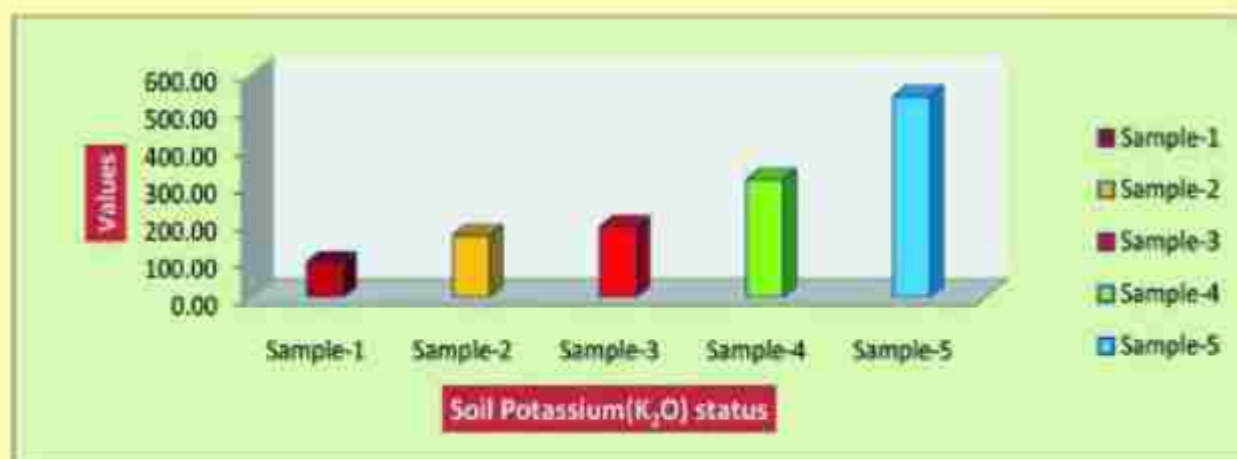
- The species of genus *Phaius* viz. *Phaius tankervilleae* and *Phaius mishmensis* prefer growing in evergreen forests and shady woodlands with constant moisture at an elevation between 1000-2000 above MSL.
- The species of genus *Calanthe* viz. *Calanthe lyroglossa* and *Calanthe masuca* also prefer growing in primary and secondary evergreen forests with an elevation of 725-1,830 mts and 150 - 1,500 mts above MSL respectively.
- The Jewel orchid (*Anoectochilus roxburghii*) and the genus *Zeuxine* also prefer shady places for its growth. The undisturbed forest habitat is found ideal for its lavish growth and development.
- *Acanthephippium sylhetense* also prefer growing in shady and damp places in dense forests which is prevalent in the area of study.
- The species *Tainia latifolia* prefers intermediate temperatures, moderate shading, high humidity and good air movement during the growing season. The species *Tainia wayana* is a rare terrestrial orchid and usually grows at elevations of 1200 to 1700 meters above MSL.

☛ Soil:

The most important parameter for the growth of the terrestrial orchids is the soil. After the soil analysis, it is observed that the terrestrial orchid species in this plot prefers acidic soil for their growth. The pH of the soil ranges from 4.28-4.84 which is extremely acidic. After the macronutrient analysis of the soil collected from the areas where terrestrial orchids were found, it is observed that the terrestrial orchids prefer soil with high organic carbon content, low phosphorus and low to very high potassium content.



B-7. Graphical representation showing soil nutrient status



B-8. Graphical representation showing Soil Potassium (K₂O) status

7.2.9 Statistical analysis :

Statistical analysis of the data obtained was carried out to determine the statistical significance of data, richness of biodiversity and extent of biodiversity with respect to epiphytic orchids and host trees. Here p value, Shannon-Weiner Diversity index and Biodiversity analysis were calculated using MS-Excel. The details of the result is shown below :

Table II (1)

OBSERVED VALUE OF JEYPORE PLOT	Borpat	Dimerat	Hingort	Hottang	Jogara	Lewa	Lataka	Merkat	Morcat	Nahar	Plantmoth	Chalalata	TOTAL
<i>Aerides odorata</i>	0	0	0	2	0	0	1	0	0	0	0	0	3
<i>Bulbophyllum careyanum</i>	0	0	2	3	0	0	0	0	4	1	0	0	10
<i>Bulbophyllum roxburghii</i>	0	0	0	2	0	0	0	0	0	0	0	0	2
<i>Bulbophyllum sikkimensis</i>	0	1	0	3	0	0	0	0	0	0	0	1	5
<i>Clelostoma subulatum</i>	0	0	0	1	0	0	0	0	0	1	0	0	2
<i>Pholidota imbricata</i>	1	0	0	0	0	0	0	0	0	0	0	0	1
<i>Dendrobium moschatum</i>	0	0	0	1	0	0	0	0	0	0	0	0	1
<i>Cymbidium aloifolium</i>	2	0	0	2	1	0	0	1	0	0	1	1	8
<i>Bulbophyllum affine</i>	0	0	0	2	0	0	0	0	0	0	0	0	2
<i>Rhynchostylis retusa</i>	0	0	0	2	1	0	0	0	2	0	0	0	5
<i>Dendrobium aphyllum</i>	0	0	0	2	0	0	0	0	0	0	0	0	2
<i>Dendrobium lituiflorum</i>	0	0	0	2	0	0	0	0	0	0	0	0	2
<i>Eria lisiopetala</i>	0	0	0	0	0	0	0	1	1	0	0	0	2
<i>Gastrochilus dasypogon</i>	0	0	0	0	0	0	1	0	0	0	0	0	1
<i>Agrostophyllum planicaule</i>	0	0	1	5	0	1	0	1	2	1	0	0	11
TOTAL	3	1	3	27	2	1	2	3	9	3	1	2	57

Total number of observations = 57

Table II(2)

pD	LNpD	pD*LNpD	H	Hmax	ORCHID EQUITABILITY
0.05	-2.94	-0.15	2.48	2.71	0.89
0.18	-1.74	-0.31			
0.04	-3.35	-0.12			
0.09	-2.43	-0.21			
0.04	-3.35	-0.12			
0.02	-4.04	-0.07			
0.02	-4.04	-0.07			
0.14	-1.96	-0.28			
0.04	-3.35	-0.12			
0.09	-2.43	-0.21			
0.04	-3.35	-0.12			
0.04	-3.35	-0.12			
0.04	-3.35	-0.12			
0.02	-4.04	-0.07			
0.19	-1.65	-0.32			

Orchid equitability = 0.89

Table II(3)

N*(N-1) (Orchid)	n*(n-1)	ORCHID BIODIVERSITY
3192	4	10.17
	90	
	2	
	20	
	2	
	0	
	0	
	56	
	2	
	20	
	2	
	2	
	2	
	0	
	110	
	314	

Orchid biodiversity = 10.17

Table II(4)

pHT	LNpHT	pHT*LNpHT	H	Hmax	HOST TREE EQUITABILITY
0.05	-2.94	-0.15	1.83	2.48	0.74
0.02	-4.04	-0.07			
0.05	-2.94	-0.15			
0.47	-0.75	-0.35			
0.04	-3.35	-0.12			
0.02	-4.04	-0.07			
0.04	-3.35	-0.12			
0.05	-2.94	-0.15			
0.16	-1.65	-0.29			
0.05	-2.94	-0.15			
0.02	-4.04	-0.07			
0.04	-3.35	-0.12			

Host tree equitability = 0.74

Table II(5)

N*(N-1) (Host Tree)	n*(n-1)	HOST TREE BIODIVERSITY
3192	4	3.97
	0	
	6	
	702	
	2	
	0	
	2	
	6	
	72	
	6	
	0	
	2	
	804	

Host tree biodiversity = 3.97

Table II(6)

t-Test: Two-Sample Assuming Unequal Variances	ORCHID	HOST TREE
Mean	4	5
Variance	11.03	53.66
Observations	15	12
df	15	
t Stat	-2.17	
P(T<=t) one-tail	0.0233	
t Critical one-tail	1.75	
P(T<=t) two-tail	0.0465	
t Critical two-tail	2.13	

p-value (one tailed) = 0.0233

p-value (two tailed) = 0.0465

From the above tables, Table II (2) and II(3), it is clear that the epiphytic orchid diversity in Jeypore study plot is very high with a value of 10.17 and their evenness is also on a higher side i.e. 0.89. In case of host tree biodiversity, this plot shows less diversity of 3.97 and a higher equitability value of 0.74 which is clearly shown in Tables II(4) and Table II(5). In respect to statistical significance, Table II(6) shows that the p value for both one tailed and two tailed lies below 0.05 which means that the data collected are statistically significant.

Photographs of orchids collected from Jeypore Study Plot



Acanthephippium sylhetense



Calanthe masuca



Tainia wrayana



Bulbophyllum affine



Bulbophyllum sikkimense



Pholidota imbricata



Cleistocactus subulatum



Rhynchosstylis retusa



Eria lasiopetala



Zeuxine nervosa



Zeuxine nervosa



Dendrobium lituiflorum



Anoectochilus roxburghii



Bulbophyllum careyanum



Aerides odorata



Calanthe lyroglossa



Calanthe lyroglossa



Dendrobium moschatum



Phaius tankervilleae



Cymbidium sp.



Bulbophyllum sp.

7.3 Plot 3, Borduar RF, Kamrup West Division under Rani Silviculture Range

7.3.1 Location:

The plot is situated at around 60 kms (approx.) by road from Guwahati under Muduki Beat, Loharghat Territorial Range falling within Borduar RF under Kamrup West Division.



7.3.2 Physiography:

The plot lies on the lower slopes of the foothills of Meghalaya Plateau. The northern part of the plot has a north western aspect and the southern part is having south eastern aspect with a gentle slope of 5%.

7.3.3 Forest type:

The orchid study area belongs to Moist Plains Sal forests-Kamrup Sal (type 3C/c 2d (ii)). Sal forms pure stands and extends up to 73% to 95%. Whips and established Sal accrue in adequate numbers where the openings in the canopy are sufficiently large.

The associate of Sal in the top storey in this type are: Makri Sal, Oaks, Ahoi, Jia, Sida, Paroli, Jam, Bhomora, Ajhar, Hingori, Ghora neem.

Comparatively in moist locations, not subjected to annual burning, the middle storey is made up of species like Narasingha, *Garcinia xanthochymus*, *Litsea* sp, etc. There are great variations in the ground

cover. In comparatively young Sal areas, areas subjected to annual burning and having a more open canopy, thatch (*Imperata cylindrica*) forms the main ground cover along with *Curcuma aromatica*, *Flemingia* sp., *Sida carpinifolia*, *Grewia sapida*, *Desmodium triquetrum*, *Premna herbacca*, *Clerodendron* sp. *Urena picta* etc. *Eupatorium odoratum* occurs along the edges of compartments near open areas and also in larger openings in the forests, but it replaces by thatch with annual burning. In closer canopied areas *Coffea bengalensis* predominates. In more moist locations *Alpinia allughus*, Ferns, *Phloganthus thyrsoflorus* etc. occur with occasional cane. Some of the other species occurring as ground cover are *Aspergus* sp, *Sida cordifolia*, *Desmodium cephalotes*, *D.laburnifolium*, *D.latifolium*, *Indigoferra* sp. *Justicia gendarussa*, *Clerodendron serratum*, *Achyra* sp., *Physanthus simplex*, *Cannabis sativa* etc.

(Source: Working Plan of Kamrup West Division)

7.3.4 Forest density:

The plot falls in the area where canopy density is 40-60%

7.3.5 Soil:

The middle and lower slopes including the foothills are composed of a deep tropical red-loam, except for places subjected to heavy erosion in some southern slopes. The soil covered by the plains forests is generally formed of deep alluvium consisting mostly of sandy loam. This alluvium tends to be clayey in stretches adjoining broad julis and frequent patches of 'Khorikani' land occur, formed by throwing up of mounds of activities of some types of earthworm. The channels intervening these mounds become water-logged during the rainy season.

(Source: Working Plan of Kamrup West Division).

7.3.6 Date of collection of Data: From 13th Aug'2021 to 17th Aug'2021

Data collection team

- Sri Sailen Das, AFS, Silviculturist, Assam
- Smt. Preeti Buragohain, Asstt. Conservator of Forests
- Smt. Himamoni Handique, Research Officer
- Sri Hirok Hindol Sharma, Fr-I i/c RO Rani Silviculture Range
- Assisted by Sarbeswar Sharma, Fr-I, Moidul Islam, Fgd and Pradip Mahanta, Fgd of Rani Silviculture Range and labourers.

7.3.7. Data collected during field survey

7.3.7.1. Local atmospheric data

- Temperature: 29.3°C- 31°C
- Humidity: 91-94 %
- Soil temperature: 30°C (soil temperature recorded from 1 ft below the earth surface)

7.3.7.2 Enumeration and marking of trees bearing orchids:

All the orchid bearing trees were marked by painting and numbering by white paint. Statement of collection of enumeration is furnished in Appendix-III.

7.3.7.3 Rehabilitation of orchids:

A total number of 6 species of wind fallen orchids were rehabilitated in living trees by tying them with coconut rope.

7.3.7.4 Procedure followed to identify epiphytic and terrestrial orchids

7.3.7.4.1 On spot identification: The morphology of the orchids was minutely observed and flowering pattern was studied in case of blooming orchids which are listed below:

Table-9 Orchids identified on-spot

Sl. No.	English Name/Local Name	Scientific name
1.	Fox tail orchid	<i>Rhynchostylis retusa</i> (L.) Blume
2.	Rattlesnake orchid	<i>Pholidota imbricata</i> Hook
3.	Carey's Bulb-leaf Orchid	<i>Bulbophyllum careyanum</i> (Hook) Spreng
4.	Flat Stemmed Agrostophyllum	<i>Agrostophyllum planicaule</i> (Wall. Ex Lindl)
5.	Red Fox Orchid	<i>Bulbophyllum sikkimense</i> (King & Pantl)
6.	Hooded orchid	<i>Dendrobium aphyllum</i> (Roxb) C.E.C. Fisch
7.	Aloe-leafed cymbidium	<i>Cymbidium aloifolium</i> (L.) Sw.
8.	The Awl-shaped Cleisostoma	<i>Cleisostma subulatum</i> Bl. Bijdr
9.	Striped Star Orchid	<i>Bulbophyllum affine</i> Lindl. Gen.
10.	Jewel orchid	<i>Aroctochilus roxburghii</i> (Wall) Lindl
11.	The Forest dwelling calanthe	<i>Calanthe masuca</i> (D.Don) Lindl.
12.	The Nerved Zeuxine	<i>Zeuxine nervosa</i> (Wall. Ex Lindl) Benth
13.	The Mishmi Hills Phaius	<i>Phaius mishmensis</i> (Lind & Paxt) Rchb.f
14.	Nun's Orchid/Kunai (tall grass) orchid	<i>Phaius tankervilleae</i> (Banks ex Herit) Bl
15.	The Musky Smelling dendrobium	<i>Dendrobium maschatum</i> (Buch-Ham) Sw.
16.	Fragrant Fox Brush Orchid	<i>Aerides odorata</i> Lour
17.	The Sylhet Acanthephippium	<i>Acanthephippium sylhetense</i> Lindl.
18.	The Shaggy Petaled Eria	<i>Eria lasiopetala</i> Willd.

7.3.7.4.2 Off-spot identification: The blooming of the orchid flowers was monitored during the subsequent months of September to November, when orchid flower start blooming and photographs were collected for each species. Characters of the flowers from the photographs was validated with records available in publication resources and orchids available in the 3 numbers of orchid houses in the division HQ and was followed by recording the English and scientific names. The list of orchids identified off spot is enlisted below.

Table-10 Orchids identified off-spot

Sl no.	English Name/Local Name	Scientific name
1.	Bent-racemed dendrobium	<i>Dendrobium lituiflorum</i> Lindley
2.	The Broad Leafed Tainia	<i>Tainia latifolia</i> (Lindl.) Rchb
3.	Wray's Tainia	<i>Tainia wrayana</i> (Hook.f)
4.	Roxburgh's Bulbophyllum	<i>Bulbophyllum roxburghii</i> (Lindl) Rchb.
5.	The Lute-shaped Lip Calanthe	<i>Calanthe lyroglossa</i> Rchb.f
6.	The Dense beard gastrochilus	<i>Gastrochilus dasypogon</i> (J.E.Sm.) Kuntze

7.3.7.5 Soil sample collection: The soil samples were collected from different locations according to standard procedure as laid down in point 5.4 and were sent to District Agricultural Office, Ulabari for macro nutrient analysis of the soil.

7.3.8. Data analysis & Result

7.3.8.1 Factors attributable: The following attributes were found responsible to derive an inference on natural orchid propagation and its behavior with relation to the existing ecosystem.

- Forest type
- Forest density
- Physiography
- Climate
- Species diversity
- Soil temperature and characteristics

7.3.8.1.1 Forest type: Since the orchid study area belongs to Moist Plains Sal forests- Kamrup Sal (type 3C/c 2d (ii), high humidity and high rainfall are the characteristic feature of the forests.

7.3.8.1.2 Forest density: The area is mostly covered with partially dense forest with mixed tree species all throughout. The plot mostly comprised of species of Sal, Makri Sal, Azar, etc.(refer Appendix-III). Epiphytes were also present.

7.3.8.1.3 Physiography: Since the plot lies on the lower slopes of the foothills of Meghalaya Plateau, the plot receives high rainfall which creates a localized microclimate in the area and thus is suitable for the growth of varieties of epiphytic orchids.

7.3.8.1.4 Climate: The region in general, enjoys a climate characterized by adequate rain during summer and cold foggy winter associated with highly humid atmosphere. The region receives an average rainfall of 400mm to 900mm during the months of April-May. During monsoon season the average annual rainfall ranges between 1500mm and 2600mm (Fig 5) The average minimum and maximum temperature recorded are 10°C and 30°C respectively (Fig 4) with relative humidity of more than 86%. This climate is congenial for the luxuriant growth of mixed deciduous forests.

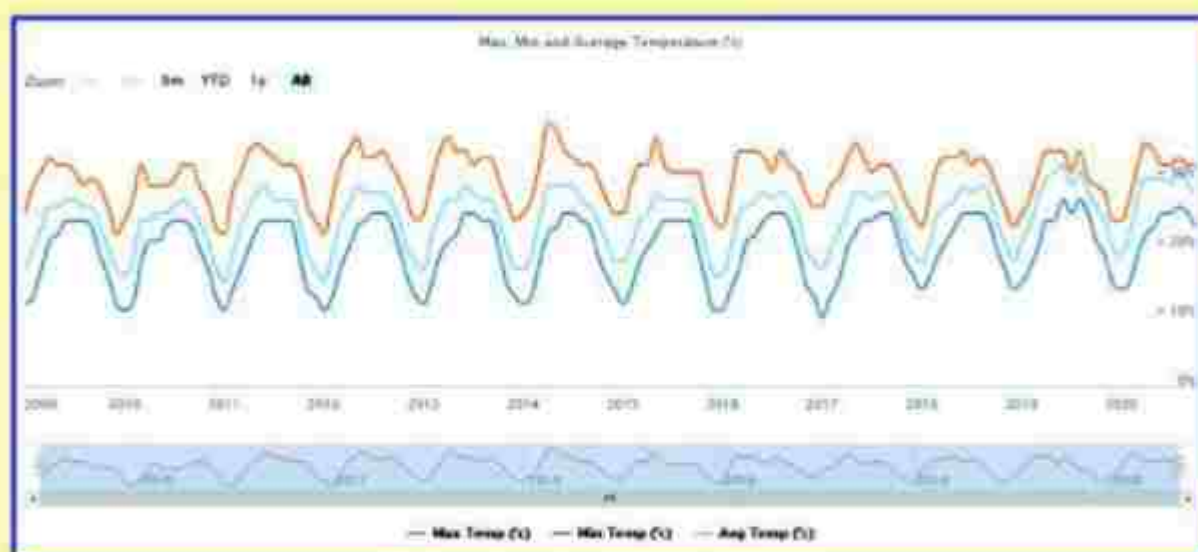


Fig 4. Max, Min and Average Temperature (°C) from 2009-2020

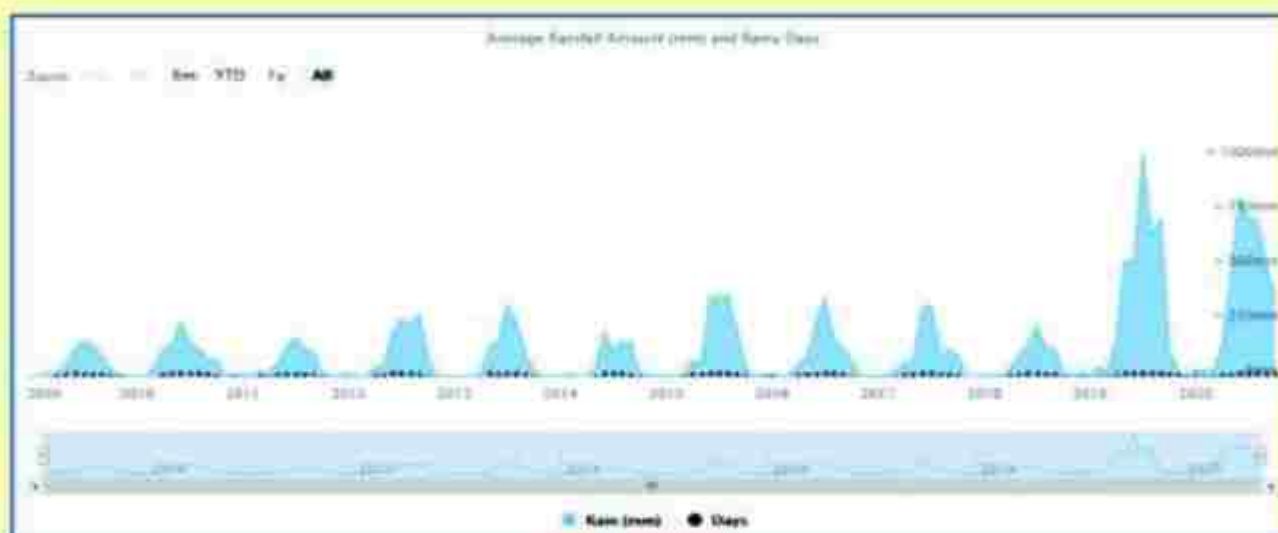


Fig 5. Monthly mean rainfall (mm) from 2009-2020

(Source: Working Plan of Ramrup West Division).

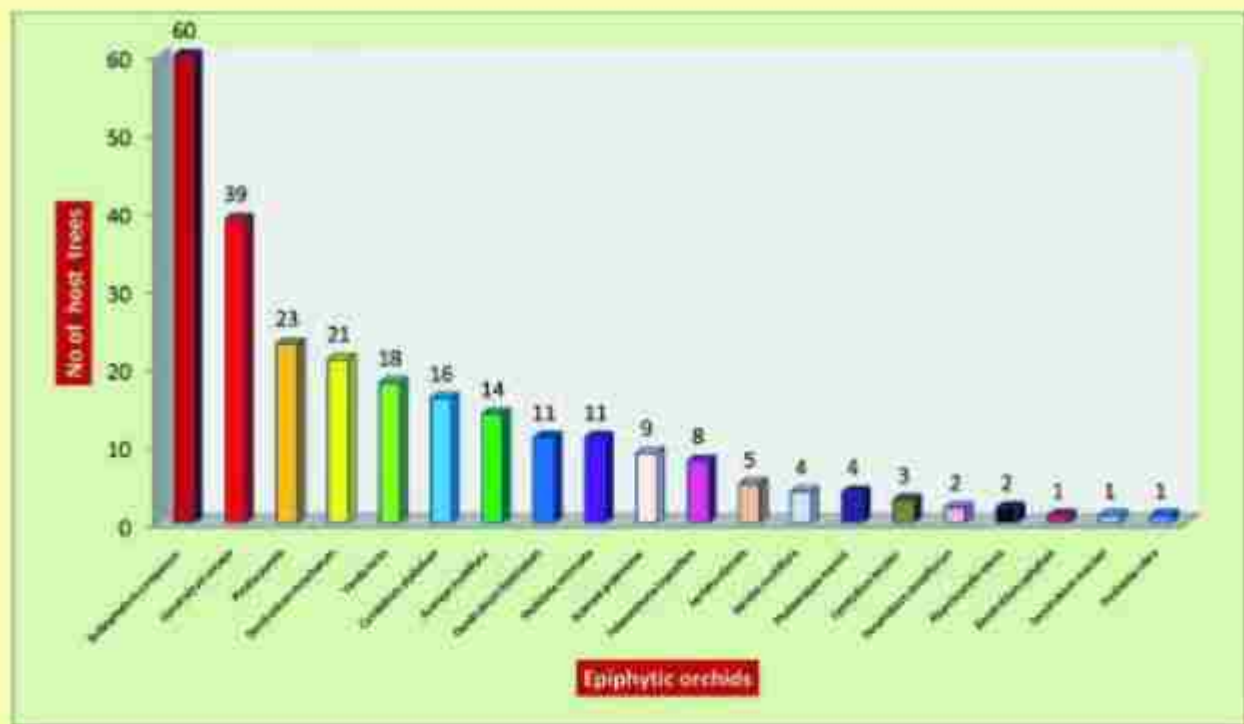
7.3.8.1.5 Species diversity

in epiphytic orchids: After analyzing the raw data from Appendix III, an effort was to establish a correlation between host trees and the epiphytic orchid species. An indicative correlation between them is furnished below:

Table 11. Epiphytic orchids with Host trees

Sl. No.	Name of epiphytic orchid species		Number of host trees associated	Host tree species
	English/Local Name	Scientific name		
1	Carey's Bulbophyllum	<i>Bulbophyllum careyanum</i> (Hook) spreng	60	Makri Sal, Ajhar, Bogipoma, Thutimala, Sal, Katakubi, Jamuk, Cham Kothal, Poma, Jiya.
2	The Large Epigeneium	<i>Dendrobium anceps</i> Sw.	39	Ajhar, Bogipoma, Sal, Katakubi, Makri Sal, Thutimala, Jamuk, Paroli, Jiya, Oxy, Cham Kothal.
3	The Dwarf Eria	<i>Pinalia pumila</i> (Lindl.)	23	Makri Sal, Ajhar, Bogipoma, Katakubi, Sal.
4	The Musky smelling Dendrobium	<i>Dendrobium moschatum</i> (Buch.-ham.) sw	21	Ajhar, Katakubi, Makri Sal, Sal, Jamuk, Paroli, Oxy.
5	Terete Vanda	<i>Vanda teres</i> (Roxb) Lindl	18	Ajhar, Thutimala, Sal, Katakubi, Cham Kothal, Makri sal, Oxy.
6	The Aloe-leaved Cymbidium	<i>Cymbidium aloifolium</i> (L) Sw	16	Ajhar, Thutimala, Sal, Makri Sal, Katakubi, Cham Kothal.
7	The Stiff acampe	<i>Acampe multiflora</i> (Lindl)	14	Ajhar, Bogipoma, Thutimala, Makri Sal, Sal, Cham Kothal.
8	The Fringe-lipped Dendrobium	<i>Dendrobium fimbriatum</i> Hook	11	Makri sal, Ajhar, Bogipoma, Katakubi, Thutimala, Paroli, Sal.
9	The Overlapping Shingle Pholidota	<i>Pholidota imbricata</i> (Roxb)	11	Ajhar, Sal, Katakubi, Oxy.
10	The Small Warty Acampe	<i>Acampe praemorsa</i> (Roxb)	9	Bogipoma, Ajhar, Thutimala, Sal

11	Insect-bearing Pelatanthera	<i>Pelatantheria insectifera</i> Rchb.f.	8	Ajhar, Bogipoma, Thutimala, Sal, Katakuhl.
12	The Fragrant Aerides	<i>Aerides odorata</i> Lour	5	Thutimala, Makri sal, Sal, Paroli, Oxy
13	The Multi-flowered Aerides	<i>Aerides multiflora</i> Roxb.	4	Thutimala, Katakuhl, Sal.
14	Mann's Phalaenopsis	<i>Phalaenopsis manni</i> Rchb.f	4	Ajhar, Sal.
15	The Two-coloured Cymbidium	<i>Cymbidium bicolor</i> Lindl.	3	Makri sal, Cham Kothal, Sal.
16	Pineapple Orchid	<i>Dendrobium densiflorum</i> Lindl	2	Makri sal, Sal
17	Fox Tail Orchid	<i>Rhynchostylis retusa</i> (L.) Blume	2	Sal, Ajhar.
18	The Hooded Dendrobium	<i>Dendrobium aphyllum</i> (Roxb.)	1	Sal.
19	The Reddish Pholidota	<i>Pholidota rubra</i> Lindl.	1	Ajhar.
20	The Macrae's Flickingeria	<i>Dendrobium macraei</i> (Lindl.)	1	Ajhar.



B-9. Graphical representation showing correlation of epiphytic orchids with host trees

Table 11 depicts the abundance of different types of epiphytic orchids in the plot. Narrowing down the focus on 4 (four) species of epiphytic orchids viz. Carey's Bulb-leaf Orchid (*Bulbophyllum careyanum*), The Large Epigeneium (*Dendrobium anceps*), The Dwarf Eria (*Pinalia pumila*) and The Musky smelling Dendrobium (*Dendrobium moschatum*) are seen growing on various host trees ranging from a minimum of 21 to maximum of 60 species.

From the field observations and other publication resources, it was found that the following factors might have triggered the growth of the epiphytic orchids in the plot: -

❖ **Climate:**

The growth of all the aforesaid epiphytic orchids require some specific climatic requirements such as;

- *Bulbophyllum* is the largest genus of the family Orchidaceae. *Bulbophyllum careyanum* is one of the most important epiphytic orchid species among the 1803 species of *Bulbophyllum*. This species is a warm to cool growing epiphyte found at elevations of 200-2100 mts above MSL. *Bulbophyllum careyanum* prefers growing in lowland forests with high humidity and requires partial shade for its growth.
- *Dendrobium anceps* is a warm growing orchid generally found in tropical and subtropical valleys at an elevation of 200 to 1400 mts. The species prefers warm to intermediate temperatures (15-32°C), high humidity and partial shade for its optimal growth.
- *Pinalia pumila* is a warm to cool growing epiphytic orchid species. It is generally seen growing in tropical valleys and mixed deciduous forests at altitudes ranging from 500 to 1700 metres.
- *Dendrobium moschatum* is a warm growing epiphyte mostly found in open forests at elevations of 300-900 metres above MSL. It prefers temperature ranging from 16-32°C, high humidity and partial shade from late spring to summer and full light rest of the year for its growth.

❖ **Wind :**

All the epiphytic orchids need moderate wind flow for the transportation of pollen essential for their propagation as well as air movement and ventilation during their entire growing period. This condition is satisfied when the tree height is more than 20 metres in the rainforests.

❖ **Host tree characteristics:**

The second most important requirement for the growth of the epiphytic orchids is the characteristics of the host trees. B-9 depicts that

- *Bulbophyllum careyanum* is growing abundantly in 60 nos of host tree species.
- *Dendrobium anceps* is growing in 39 nos of host tree species.
- *Pinalia pumila* is growing in 23 nos. of host tree species.
- *Dendrobium moschatum* is growing in 21 nos. of host tree species.

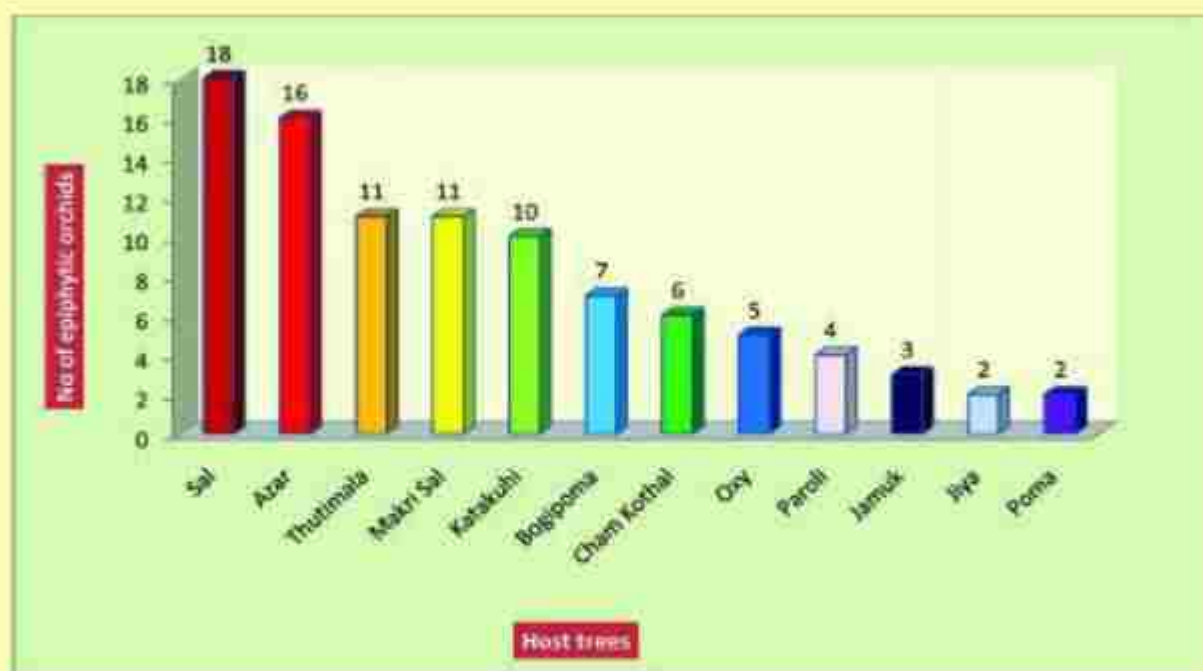
It is observed that all the host tree species are mostly semi-deciduous to deciduous with little to medium sized leaves.

❖ **Bark characteristics:**

The bark of the host trees is another most important parameter where the roots of the epiphytic orchids cling and thus aids in the natural regeneration of the epiphytic orchids. In this plot, the bark of the host trees is rough in texture with longitudinal fissures. The rough texture of the bark helps the pollens to establish in the crevices and thus helps in the propagation of epiphytic orchids simultaneously.

Table 12. Host trees with epiphytic orchid species

Sl. No.	Name of host tree species		Number of epiphytic orchid species associated	Epiphytic orchid species
	English/Local Name	Scientific name		
1	Sal	<i>Shorea robusta</i> Roth	18	<i>Acampe multiflora</i> , <i>Acampe praemorsa</i> , <i>Aerides multiflora</i> , <i>Aerides odoratum</i> , <i>Bulbophyllum careyanum</i> , <i>Cymbidium aloifolium</i> , <i>Cymbidium pendulum</i> , <i>Dendrobium anceps</i> , <i>Dendrobium aphyllum</i> , <i>Dendrobium aphyllum</i> , <i>Dendrobium fimbriatum</i> , <i>Dendrobium moschatum</i> , <i>Pelatantheria Insectifera</i> , <i>Phalaenopsis mannii</i> , <i>Pholidota imbricata</i> , <i>Pinalia pumila</i> , <i>Rhynchostylis retusa</i> , <i>Vanda teres</i>
2	Azar	<i>Lagerstroemia speciosa</i> (L.) Pers.	16	<i>Vanda teres</i> , <i>Acampe multiflora</i> , <i>Bulbophyllum careyanum</i> , <i>Dendrobium fimbriatum</i> , <i>Dendrobium anceps</i> , <i>Dendrobium moschatum</i> , <i>Pholidota robra</i> , <i>Pelatantheria Insectifera</i> , <i>Pinalia pumila</i> , <i>Dendrobium macraei</i> , <i>Pholidota imbricata</i> , <i>Cymbidium aloifolium</i> , <i>Phalaenopsis mannii</i> , <i>Acampe praemorsa</i> , <i>Pelatantheria Insectifera</i> , <i>Rhynchostylis retusa</i>
3	Makri Sal	<i>Schinus wallichii</i> (DC.) Korth.	11	<i>Bulbophyllum careyanum</i> , <i>Dendrobium densiflorum</i> , <i>Dendrobium fimbriatum</i> , <i>Pinalia pumila</i> , <i>Cymbidium aloifolium</i> , <i>Dendrobium anceps</i> , <i>Dendrobium moschatum</i> , <i>Aerides odoratum</i> , <i>Acampe multiflora</i> , <i>Vanda teres</i> , <i>Cymbidium pendulum</i>
4	Thuttimala	<i>Garuga pinnata</i> Roxb.	11	<i>Acampe multiflora</i> , <i>Acampe praemorsa</i> , <i>Aerides multiflora</i> , <i>Aerides odoratum</i> , <i>Bulbophyllum careyanum</i> , <i>Cymbidium aloifolium</i> , <i>Dendrobium anceps</i> , <i>Dendrobium fimbriatum</i> , <i>Pelatantheria Insectifera</i> , <i>Pinalia pumila</i> , <i>Vanda teres</i>
5	Katakuti	<i>Bridelia retusa</i> (L.) A.Juss.	10	<i>Dendrobium fimbriatum</i> , <i>Pholidota imbricata</i> , <i>Aerides multiflora</i> , <i>Dendrobium anceps</i> , <i>Dendrobium moschatum</i> , <i>Bulbophyllum careyanum</i> , <i>Pinalia pumila</i> , <i>Pelatantheria Insectifera</i> , <i>Cymbidium aloifolium</i> , <i>Vanda teres</i>
6	Bogipoma	<i>Chukrasia tabularis</i> A.Juss.	7	<i>Bulbophyllum careyanum</i> , <i>Pelatantheria Insectifera</i> , <i>Pinalia pumila</i> , <i>Dendrobium fimbriatum</i> , <i>Acampe multiflora</i> , <i>Dendrobium anceps</i> , <i>Acampe praemorsa</i>
7	Cham Kothal	<i>Artocarpus chama</i> Buch-Ham.	6	<i>Bulbophyllum careyanum</i> , <i>Cymbidium aloifolium</i> , <i>Vanda teres</i> , <i>Acampe multiflora</i> , <i>Cymbidium pendulum</i> , <i>Dendrobium anceps</i>
8	Oxy	<i>Paulownia elongata</i> X <i>paulownia fortunei</i>	5	<i>Pholidota imbricata</i> , <i>Dendrobium moschatum</i> , <i>Dendrobium anceps</i> , <i>Vanda teres</i> , <i>Aerides odoratum</i>
9	Parol	<i>Stereospermum chelonoides</i> DC.	4	<i>Aerides odoratum</i> , <i>Dendrobium anceps</i> , <i>Dendrobium fimbriatum</i> , <i>Dendrobium moschatum</i>
10	Jantuk	<i>Syzygium cumini</i> (L.) Skeels.	3	<i>Bulbophyllum careyanum</i> , <i>Dendrobium anceps</i> , <i>Dendrobium moschatum</i>
11	Jiya	<i>Citrus × sinensis</i> (L.) Osbeck	2	<i>Bulbophyllum careyanum</i> , <i>Dendrobium anceps</i>
12	Poma	<i>Toona ciliata</i> M. Roem.	2	<i>Pinalia pumila</i> , <i>Bulbophyllum careyanum</i>



B-10. Graphical representation showing correlation of host trees with epiphytic orchids

From Table 12, it is evident that 4 (four) species of host trees viz. Sal, Azar, Makri Sal and Thutimala are found to host diverse species of epiphytic orchids ranging from a minimum of 11 to a maximum of 18 species of epiphytic orchids. From the field study as well as other publication resources, it was found that the trees in the forests bear the following characteristics which makes them suitable for harbouring different species of epiphytic orchids.

➤ **Height of the tree:**

The height of the tree is one of the important features which affects the growth of the epiphytic orchids. During the study, it is observed that the host trees bearing height above 15 metres is seen to host the maximum number of species of epiphytic orchids. Because of their height, these trees help the epiphytic orchids to receive adequate quantity of sunlight for their growth. Moreover, all the trees are semi-deciduous to deciduous in nature which further fulfills the requirement of partial shade for the growth of epiphytic orchids.

➤ **Bark characteristics:**

In this plot, the bark of the host trees is mostly rough in texture. The bark of Sal (*Shorea robusta*) and Makri Sal (*Schima wallichii*) is rough and ruggedly cracked into longitudinal fissures which is preferred by the epiphytic orchids for clinging into the surface. Whereas the bark of Azar (*Lagerstroemia speciosa*) and Thutimala (*Garuga pinnata*) is somewhat smooth with shallow fissures and exfoliates in thin papery flakes. During the field study, it is observed that the peeled off flakes are attached to the roots of the epiphytic orchids and they act as a medium for absorption of moisture and nutrition from the environment which further enhances the growth of these epiphytic orchids.

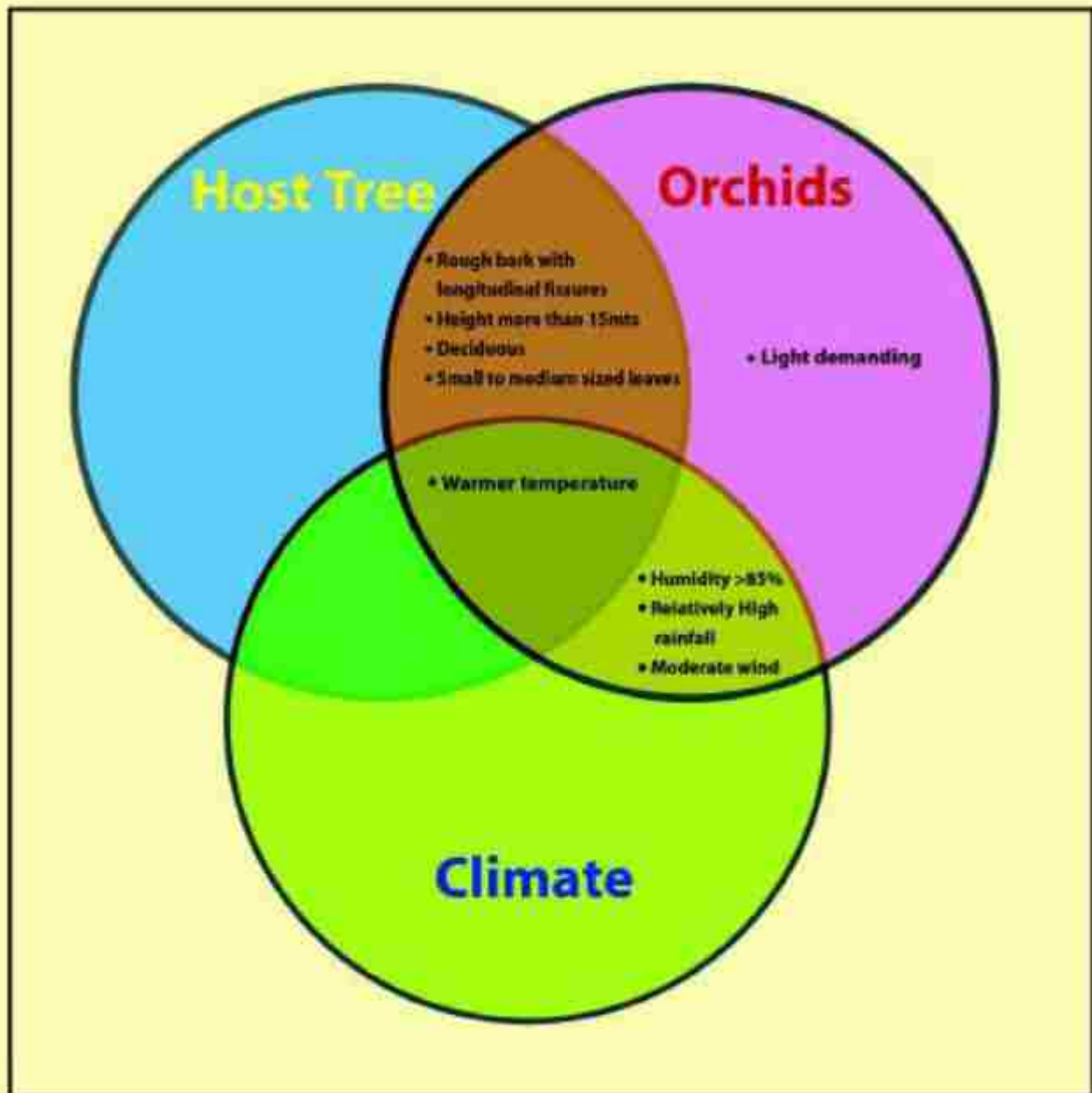
➤ **Leaf characteristics:**

The host tree species bearing the epiphytic orchids are mostly semi-deciduous to deciduous with small to medium-sized leaves. Therefore, the host trees provide partial shade to the epiphytic orchids during their entire growth period.

Rest of the epiphytic orchids and host trees have a lesser affinity towards each other due to reduced matching with respect to preference of the epiphytic orchids and the characteristics of the host trees. It may be inferred that there is a direct and indirect correlation among

- (a) climate;
- (b) topography;
- (c) characteristics of host trees; and
- (d) sustenance of epiphytic orchids-

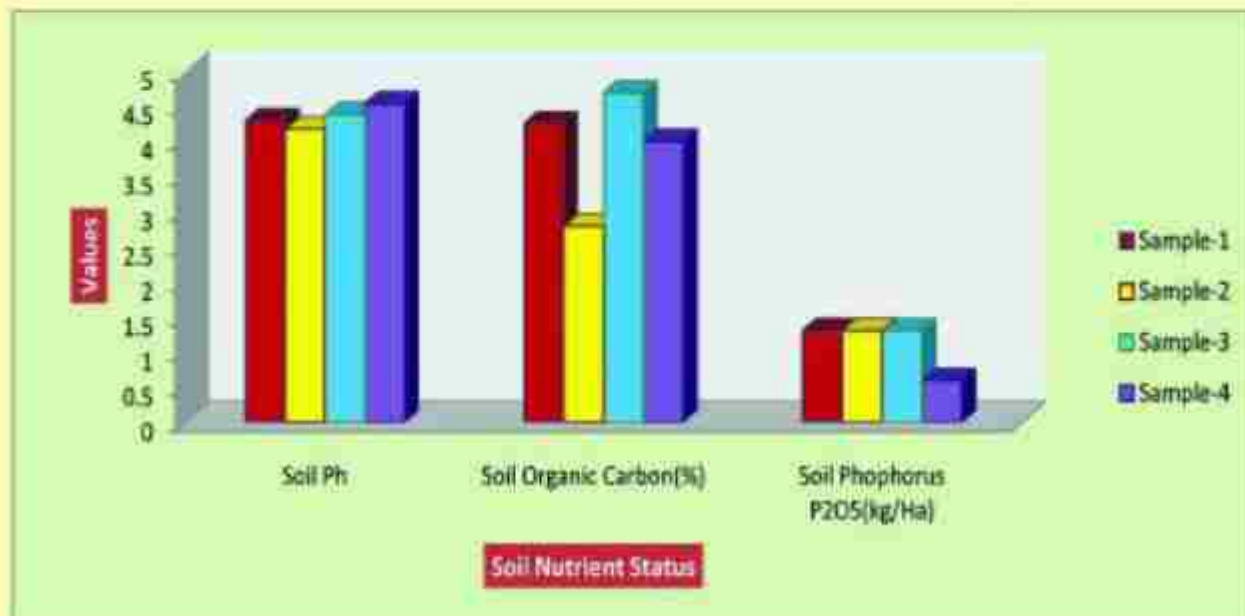
in a particular ecosystem. The indicator of this complex dynamics can be observed in the plot where there is a localized development of humid micro climate due to transpiration of moisture by host trees as well as epiphytic orchids.



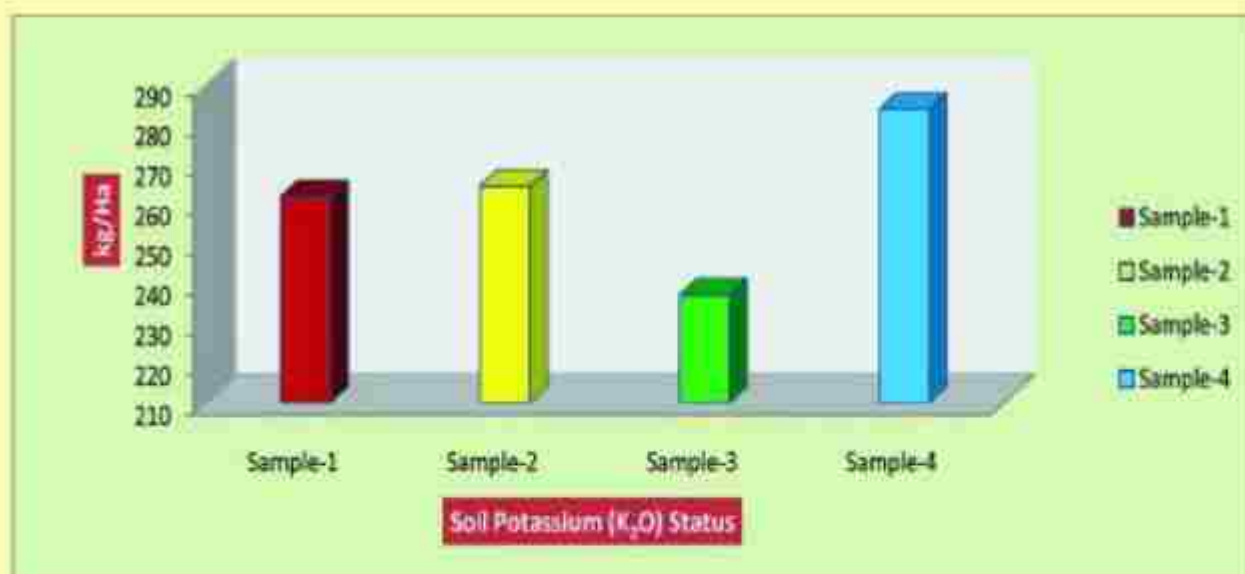
Y-3. Venn diagram showing epiphytic orchid and host tree relationship dynamics

7.3.9 Soil analysis :

The test results of the soil analysis reveal that the average organic carbon content of the plot ranges from 2.79 - 4.69 %, phosphorus content ranges from 0.598 - 1.307 kg/ha and potash content ranges from 237.08 - 283.72 kg/ha. The average soil pH of the plot ranges from 4.17 - 4.53 which is slightly acidic.



B-11. Graphical representation of soil nutrient status



B-12. Graphical representation of Soil Potassium (K₂O) status

7.3.10 Statistical analysis :

Statistical analysis of the data obtained was carried out to determine the statistical significance of data, richness of biodiversity and extent of biodiversity with respect to epiphytic orchids and host trees. Here p value, Shannon-Weiner Diversity index and Biodiversity analysis were calculated using MS-Excel. The details of the result is shown below :

Table III(1)

OBSERVED VALUE OF RANI PLOT	Azar	Bogipoma	Sam Kathal	Jamak	Ja	Kota kuhl	Makri Sal	Ovi	Paroli	Poma	Sal	Thitim ala	TOTAL
<i>Acampe multiflora</i>	7	1	1	0	0	0	1	0	0	0	3	1	14
<i>Acampe praemorsa</i>	4	1	0	0	0	0	0	0	0	0	3	1	9
<i>Aerides multiflora</i>	0	0	0	0	0	1	0	0	0	0	1	2	4
<i>Aerides odoratum</i>	0	0	0	0	0	0	1	1	1	0	1	1	5
<i>Bulbophyllum caryatum</i>	6	1	6	1	1	2	8	0	0	1	32	2	60
<i>Cymbidium ulisfolium</i>	2	0	1	0	0	1	5	0	0	0	6	1	16
<i>Cymbidium pendulum</i>	0	0	1	0	0	0	1	0	0	0	1	0	3
<i>Dendrobium anceps</i>	7	1	1	1	1	2	8	1	1	0	15	1	39
<i>Dendrobium aptulum</i>	0	0	0	0	0	0	0	0	0	0	1	0	1
<i>Dendrobium densiflorum</i>	0	0	0	0	0	0	1	0	0	0	1	0	2
<i>Dendrobium fimbriatum</i>	4	1	0	0	0	2	1	0	1	0	1	1	11
<i>Dendrobium macraei</i>	1	0	0	0	0	0	0	0	0	0	0	0	1
<i>Dendrobium maschotum</i>	5	0	0	1	0	1	3	1	1	0	9	0	21
<i>Pelatantheria insectifera</i>	3	1	0	0	0	1	0	0	0	0	2	1	8
<i>Phalaenopsis manii</i>	3	0	0	0	0	0	0	0	0	0	1	0	4
<i>Pholidota imbricata</i>	2	0	0	0	0	2	0	1	0	0	6	0	11
<i>Pholidota rubra</i>	1	0	0	0	0	0	0	0	0	0	0	0	1
<i>Pisalia pumila</i>	2	1	0	0	0	2	5	0	0	1	11	1	23
<i>Rhynchostylis retusa</i>	1	0	0	0	0	0	0	0	0	0	1	0	2
<i>Vanda teres</i>	9	0	2	0	0	1	2	1	0	0	2	1	18
TOTAL	57	7	12	3	2	15	36	5	4	2	97	13	253

Total number of observations = 253

Table III(2)

p0	LNp0	p0*LNp0	H	HmaxD	ORCHID EQUITABILITY
0.06	-2.09	-0.16	2.48	1.00	0.83
0.04	-3.34	-0.12			
0.02	-4.35	-0.07			
0.02	-3.92	-0.08			
0.24	-1.44	-0.34			
0.06	-2.76	-0.17			
0.01	-4.43	-0.05			
0.15	-1.87	-0.29			
0.00	-5.53	-0.02			
0.01	-4.84	-0.04			
0.04	-3.34	-0.14			
0.00	-5.53	-0.02			
0.08	-2.49	-0.21			
0.03	-3.45	-0.11			
0.02	-4.35	-0.07			
0.04	-3.34	-0.14			
0.00	-5.53	-0.02			
0.09	-2.40	-0.22			
0.01	-4.84	-0.04			
0.07	-2.64	-0.19			

Orchid equitability = 0.83

Table III(3)

N*(N-1) (Orchid)	n*(n-1)	ORCHID BIODIVERSITY
63756	182	9.01
	72	
	12	
	20	
	3540	
	240	
	6	
	1482	
	0	
	2	
	178	
	0	
	420	
	56	
	12	
	110	
	0	
	506	
	2	
	306	
	7878	

Orchid biodiversity = 9.01

Table III(4)

pHT	LNpHT	pHT*LNpHT	H	HmaxHT	HOST TREE EQUITABILITY
0.23	-1.49	-0.34	1.82	2.48	0.73
0.03	-3.59	-0.10			
0.05	-3.05	-0.14			
0.01	-4.43	-0.05			
0.01	-4.84	-0.04			
0.06	-2.83	-0.17			
0.14	-1.95	-0.28			
0.02	-3.92	-0.08			
0.02	-4.15	-0.07			
0.01	-4.84	-0.04			
0.38	-0.96	-0.37			
0.05	-2.97	-0.15			

Host tree equitability = 0.73

Table III(5)

N*(N-1) (Host Tree)	n*(n-1)	HOST TREE BIODIVERSITY
63756	3192	9.01
	42	
	132	
	6	
	2	
	210	
	1260	
	20	
	12	
	2	
	9312	
	156	
	14346	

Host tree biodiversity = 9.01

Table III(6)

t-Test: Two-Sample Assuming Unequal Variances	ORCHID	HOST TREE
Mean	13	21
Variance	217.3974	842.2652
Observations	20	12
df	14	
t Stat	-3.16	
P(T<=t) one-tail	0.0035	
t Critical one-tail	1.76	
P(T<=t) two-tail	0.0035	
t Critical two-tail	2.14	

p value (one tailed) = 0.0035

p value (two tailed) = 0.0035

Table III (2) and Table III(3) depicts that the epiphytic orchid diversity in Borduar study plot is high showing a value of 9.01 and the equitability is also on a higher side with value of 0.83. In case of host tree biodiversity, this plot shows high diversity of 9.01 and a higher equitability value of 0.73 which is clearly shown in Tables III(4) and Table III(5). In respect to statistical significance, Table III(6) shows that the p value for both one tailed and two tailed lies below 0.05 which means that the data collected are statistically significant.

Photographs of orchids collected from Borduar Study plot



Acampe praemorsa

Cymbidium sp

Bulbophyllum sp



Pholidota imbricata

Rhynchostylis retusa

Cymbidium aloifolium



Rhynchostylis retusa



Pelatantheria insectifera



Dendrobium aphyllum



Dendrobium macraei



Vanda teres



Phalaenopsis mannii



Aerides multiflora



Acampe multiflora

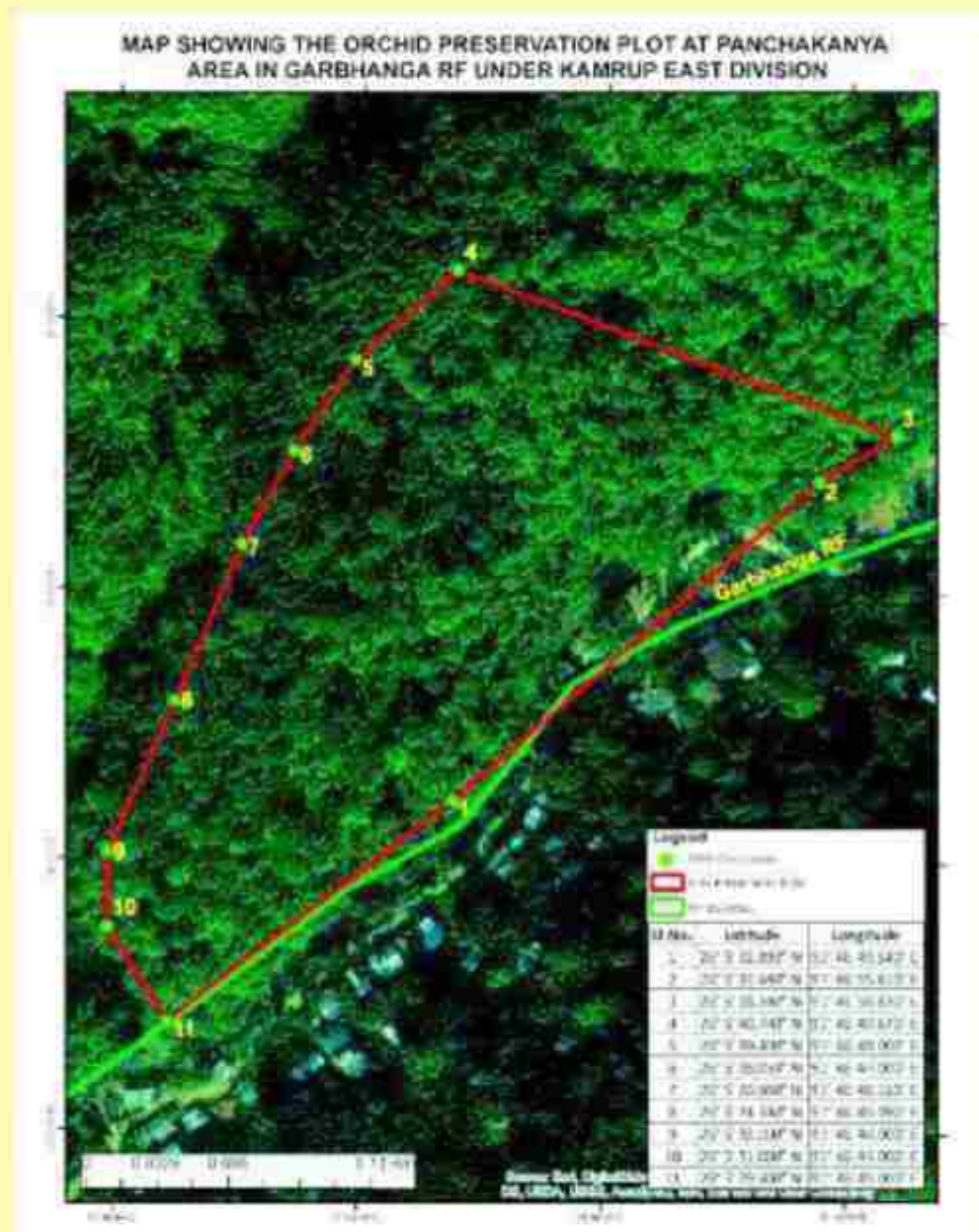


Cymbidium bicolor

7.4 Plot 4, Garbhanga RF, Panchakanya, Kamrup East Division under Basistha Silviculture Range

7.4.1 Location:

The plot is situated at around 3 kms from Silviculture Division Headquarter, Basistha under Basistha Beat, South Guwahati Range falling within Garbhanga RF under Kamrup East Division, Basistha.



7.4.2 Physiography:

The plot is lying on the slopes of hillocks with an average south-eastern aspect and average slope ranging from 30% to 45%. A stream is also flowing along the Southern boundary of the plot.

7.4.3 Forest type:

Although the forest type under Kamrup East Division falls under Eastern Hill Sal Forest - Khasi Hills Sal and almost all the areas are dominated by Sal, the orchid study area was chosen based on the availability of diverse species of epiphytic as well as presence of terrestrial orchid species' patches. The orchid study plot is basically a Teak Plantation area. Other naturally available species are Sal (*Shorea robusta*), Makri Sal (*Schima wallichii*), Baji Ou (*Dillenia scabrella*) etc. The understory vegetation

comprised of thatch (*Imperata cylindrica*), *Eupatorium odoratum*, *Clerodendron* species etc. Some climbers were also observed viz. Bandarkekowa [*Mucuna prusita*], Bhedailota (*Paederia scandens*), Dhakialota (*Stenochleana palustre*). Bamboo brakes were also noted in some patches. The dominant bamboo species observed are Kako (*Dendrocalamus hamiltonii*) and Bijuli (*Bambusa pallida*).

7.4.4 Forest density: Since the plot falls in a teak plantation area with some naturally growing trees, the canopy density was observed to be 35-55% based on ocular estimation.

7.4.5 Soil: The soil type within the forest areas mostly comprises of sandy loam and red soil. The overall organic carbon and nitrogen contents are usually high in the soil.

7.4.6 Date of collection of Data: From 19th Jan'2021 to 21st Jan'2021

Data collection team

- Sri Sailem Das, AFS, Silviculturist, Assam
- Smt. Preeti Buragohain, Asstt. Conservator of Forests
- Smt. Himamoni Handique, Research Officer
- Sri Niraj Das, R.O. Basistha Silviculture Range.
- Assisted by Pranjal Prakash Das, Fr-I, Hirok Hillol Sharma, Fr-I Himangshu Bhattacharjee, Fr-I and other staffs of Basistha Silviculture Range and labourers.

7.4.7 Data collected during field survey

7.4.7.1 Local atmospheric data

- Temperature: 27.3°C
- Humidity: 54-55%
- Soil temperature: 25.1°C (soil temperature recorded from 1 ft below the earth surface)

7.4.7.2 Enumeration and marking of trees bearing orchids:

All the orchid bearing trees were marked by painting and numbering by white paint. Statement of collection of enumeration is furnished in Appendix-IV.

7.4.7.3 Rehabilitation of orchids:

A total number of 2 species of wind fallen orchids were rehabilitated in living trees by tying them with coconut rope.

7.4.7.4 Procedure followed to identify epiphytic and terrestrial orchids

7.4.7.4.1 On spot identification: The morphology of the orchids was minutely observed and flowering pattern was studied in case of blooming orchids which are listed below:

Table-13 Orchids identified on-spot

Sl. No.	English Name/Local Name	Scientific name
1	Fragrant Fox Brush Orchid	<i>Aerides odorata</i> Lour.
2	Aloe-leafed cymbidium	<i>Cymbidium aloifolium</i> (L.)Sw.
3	The Terete Leaf Papilionanthe	<i>Vanda teres</i> Roxb.
4	Carey's Bulbophyllum	<i>Bulbophyllum careyanum</i> (Hook) Spreng
5	Many Flowered Fox Brush Orchid	<i>Aerides multiflora</i> Roxb
6	Hooded Orchids	<i>Dendrobium aphyllum</i> Roxb
7	Foxtail Orchid	<i>Rhyncostyles retusa</i> (L.)Bl
8	Stiff acampe	<i>Acampe multiflora</i> (Lindl.) Lindl.

7.4.7.5 Soil sample collection: The soil samples were collected from different locations according to standard procedure as laid down in point 5.4 and were sent to District Agricultural Office, Ulubari for macro nutrient analysis of the soil.

7.4.8 Data analysis & Result

7.4.8.1 Factors attributable: The following attributes were found responsible to derive an inference on natural orchid propagation and its behavior with relation to the existing ecosystem.

- **Forest type**
- **Forest density**
- **Physiography**
- **Climate**
- **Species diversity**
- **Soil temperature and characteristics**

7.4.8.1.1 Forest type: During reconnaissance survey, the species like Sal, Makri Sal, Paroli, etc were seen hosting orchid species like *Aerides odorata*, *Vanda teres*, *Rhyncostyles retusa*, etc. but incidently, the orchid preservation plot falls within a teak plantation area where orchids are being hosted by Teak (*Tectona grandis*) species. It may be established that in broader purview, orchids are found in these forests of Eastern Hill Sal Forest - Khasi Hills Sal Forest type and Teak species exhibit some of orchid friendly characteristics similar to other orchid bearing tree species and hence orchid is found growing in Teak particularly.

7.4.8.1.2 Forest density: The orchid study plot falls under Teak plantation and it is highly stocked but due to exfolage, the ocular estimation of density could not be carried out. Deducing from the growing stock of teak plantation, the density of the deciduous forests may be stated from 35-55%.

7.4.8.1.3 Physiography: As most of the area of the plot is located at the south eastern aspect as a result the vegetation receives sizeable quantity of sunlight throughout the day. In addition, since the Teak (*Tectona grandis*), Sal (*Shorea robusta*) and Makri Sal (*Schima wallichii*) tree species are of deciduous nature, the light demanding epiphytic orchids are seen growing in these trees. Moreover, the defoliation of leaves also helps in adding humus to the soil which might have resulted in the growth of terrestrial orchid species. The stream flowing along the southern boundary of the plot created a microclimate in the plot and it is observed that most of the epiphytic orchids are found along the boundary only and the quantity of the orchid species lessened across the slopes and the top of the hillock.

7.4.8.1.4 Climate:

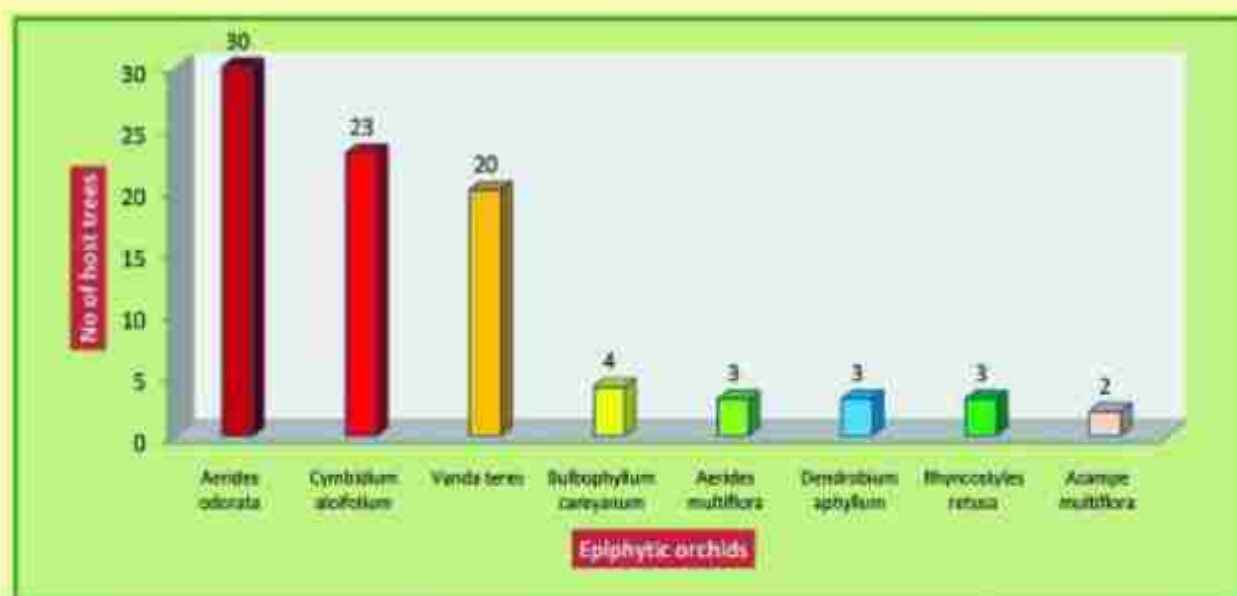
The climate of the area is of sub-tropical type characterized by the excessive moisture. The rise of temperature is checked by frequent showers and thunder storms. The change of season is therefore, not marked by the extreme contrasts of temperature and humidity. The annual rainfall on average varies from 144.54 -241.68 mm.

7.4.8.1.5 Species diversity in epiphytic orchids:

After analyzing the raw data from Appendix-IV, an effort was made to establish a correlation between host trees and the epiphytic orchid species. An indicative correlation between them is furnished below:

Table 14. Epiphytic orchids with Host trees

Sl. No.	Name of epiphytic orchid species		Number of host trees associated	Host tree species
	English/Local Name	Scientific name		
1	Fragrant Fox Brush Orchid	<i>Aerides odorata</i> Lour.	30	Teak, Sal,
2	Aloe-leaved cymbidium	<i>Cymbidium aloifolium</i> (L.)Sw.	23	Teak, Sal, Makri sal,
3	The Terete Leaf Papilionanthe	<i>Vanda teres</i> Roxb.	20	Teak.
4	Carey's Bulbophyllum	<i>Bulbophyllum careyanum</i> (Hook) Spreng	4	Makri sal, Sal, Bajl Ou,
5	Many Flowered Fox Brush Orchid	<i>Aerides multiflora</i> Roxb	3	Teak
6	Hooded Orchids	<i>Dendrobium aphyllum</i> Roxb	3	Teak.
7	Foxtail Orchid	<i>Rhynchostylis retusa</i> (L.)Bl	3	Teak
8	Stiff acampe	<i>Acampe multiflora</i> (Lindl.) Lindl.	2	Teak



B-13. Graphical representation showing correlation of epiphytic orchids with host trees

From Table-14, narrowing down the focus on 3 nos. of epiphytic orchids which were found growing abundantly in the plot were Fragrant Fox Brush Orchid (*Aerides odorata*), Aloe-leaved cymbidium (*Cymbidium aloifolium*) and Terente Leaf Papilionanthe (*Vanda teres*). These epiphytic orchids are seen growing on various host trees ranging from minimum of 20 to maximum 30 species of host trees.

From the field observations and other publication resources, it was found that the orchids require the following specific favourable conditions for their growth: -

❏ **Climate:**

The growth of all the aforesaid epiphytic orchid requires some specific climatic requirements such as:

- *Aerides odorata* is an endangered hot to cool growing epiphytic orchid which is generally found in the broadleaf lowland forests. This epiphytic orchid is a light demanding species and thus grows high up in the trees. This species is generally found growing at an altitude ranging from 200 to 2000 metres above MSL.
- *Cymbidium aloifolium* also requires warm and humid climate in their growing period i.e. 20-24 °C and cool climate in flowering seasons i.e. 10-20°C. They prefer light shade from the midday sun and relative humidity of 50-80%.
- *Vanda teres* also prefers warm temperature and bright light for its growth. This epiphytic orchid generally prefers warm temperature during the day (18°C) and night temperature not lower than 15°C. Relative humidity around 80% is appropriate during its entire growth period.

❏ **Wind :**

All the epiphytic orchids need moderate wind flow for the transportation of pollen essential for their propagation as well as air movement and ventilation during their entire growing period. This condition is satisfied when the tree height is more than 15 metres.

❏ **Physiography:**

The epiphytic orchids mostly grow in the south eastern aspect of the plot where they receive adequate exposure to sunlight and rain.

- *Aerides odorata* grows well at an altitude ranging from 200 to 2000 meters above MSL
- *Cymbidium aloifolium* found growing at an elevation of 120-1100 meters above MSL
- *Vanda teres* grows at an altitude of 800 mts above MSL

❏ **Host tree characteristics:**

The second most important requirement for the growth of the epiphytic orchids is the characteristics of the host trees. B-13 depicts that

- *Aerides odorata* is growing abundantly in 30 nos of host tree species.
- *Cymbidium aloifolium* is seen growing in 23 nos of host tree species.
- *Vanda teres* is growing in 20 nos. of host tree species.

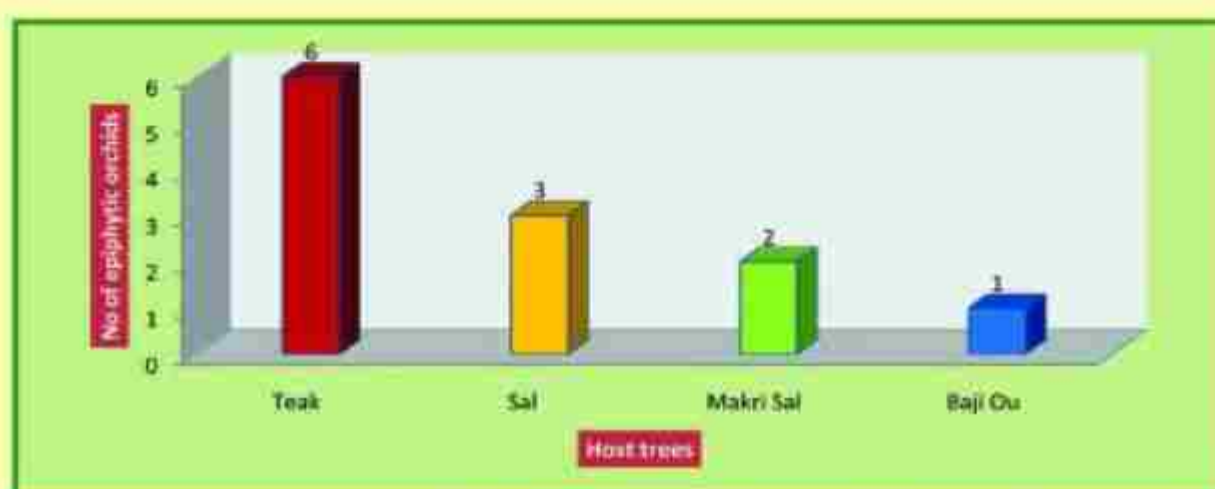
It is observed that all the host tree species are mostly deciduous with medium to broad sized leaves.

❏ **Bark characteristics:**

Another preference of the epiphytic orchids is the bark of the host trees where the epiphytic orchids establish themselves. It is observed that the epiphytic orchids in this plot prefers rough and fissured bark for their attachment and subsequent growth.

Table 15. Host trees with epiphytic orchid species

Sl. No.	Name of host tree species		Number of epiphytic orchid species associated	Epiphytic orchid species
	English/Local Name	Scientific name		
1	Teak	<i>Tectona grandis</i> L.f.	6	<i>Cymbidium aloifolium</i> , <i>Vanda teres</i> , <i>Aerides odorata</i> , <i>Rhynchosstylis retusa</i> , <i>Dendrobium aphyllum</i> , <i>Aerides multiflora</i> .
2	Sal	<i>Shorea robusta</i> Roth	3	<i>Cymbidium aloifolium</i> , <i>Bulbophyllum careyanum</i> , <i>Aerides odorata</i>
3	Makri Sal	<i>Schima wallichii</i> (DC.) Korth.	2	<i>Cymbidium aloifolium</i> , <i>Bulbophyllum careyanum</i> .
4	Baji Ou	<i>Dillenia scabrella</i> (D. Don) Roxb. ex Wall.	1	<i>Bulbophyllum careyanum</i>



B-14. Graphical representation showing correlation of host trees with epiphytic orchids

From Table-15, it is clear that 4 (four) species of host trees viz. Teak (*Tectona grandis*), Sal (*Shorea robusta*) and Makri Sal (*Schima wallichii*) are found to host from minimum of 1 species to maximum of 6 diverse species of epiphytic orchids out of 8 species identified.

From the field study as well as other publication resources, it was found that the host trees bearing the following characteristics are suitable for harbouring epiphytic orchids.

- ☛ **Height of the tree:** The height of the tree is one of the important features which affects the growth of the epiphytic orchids. The epiphytic orchids are seen growing mostly in tall trees like, Teak having an average height of 35-40 meters, Sal with an average height of 30-35 meters and Makri Sal with an average height of 20 meters. The above host trees bear the maximum number of orchid species as all the epiphytic orchid species are mostly light demanding and the tall trees help them to fetch the adequate amount of sunlight for their growth.
- ☛ **Bark characteristics:** All the host trees are having rough fissured bark which is preferred more by the epiphytic orchids for grasping/clinging into the surface and for natural regeneration.
- ☛ **Leaf characteristics:** In this plot it is observed that all the host trees bearing the epiphytic orchids are deciduous in nature. This clearly depicts that the epiphytic

orchids growing in these host trees require full sun during a particular phase of their growth period.

Rest of the epiphytic orchids and host trees have a lesser affinity towards each other due to reduced matching with respect to preference of the epiphytic orchids and the characteristics of the host trees. It may be inferred that there is a direct and indirect correlation among

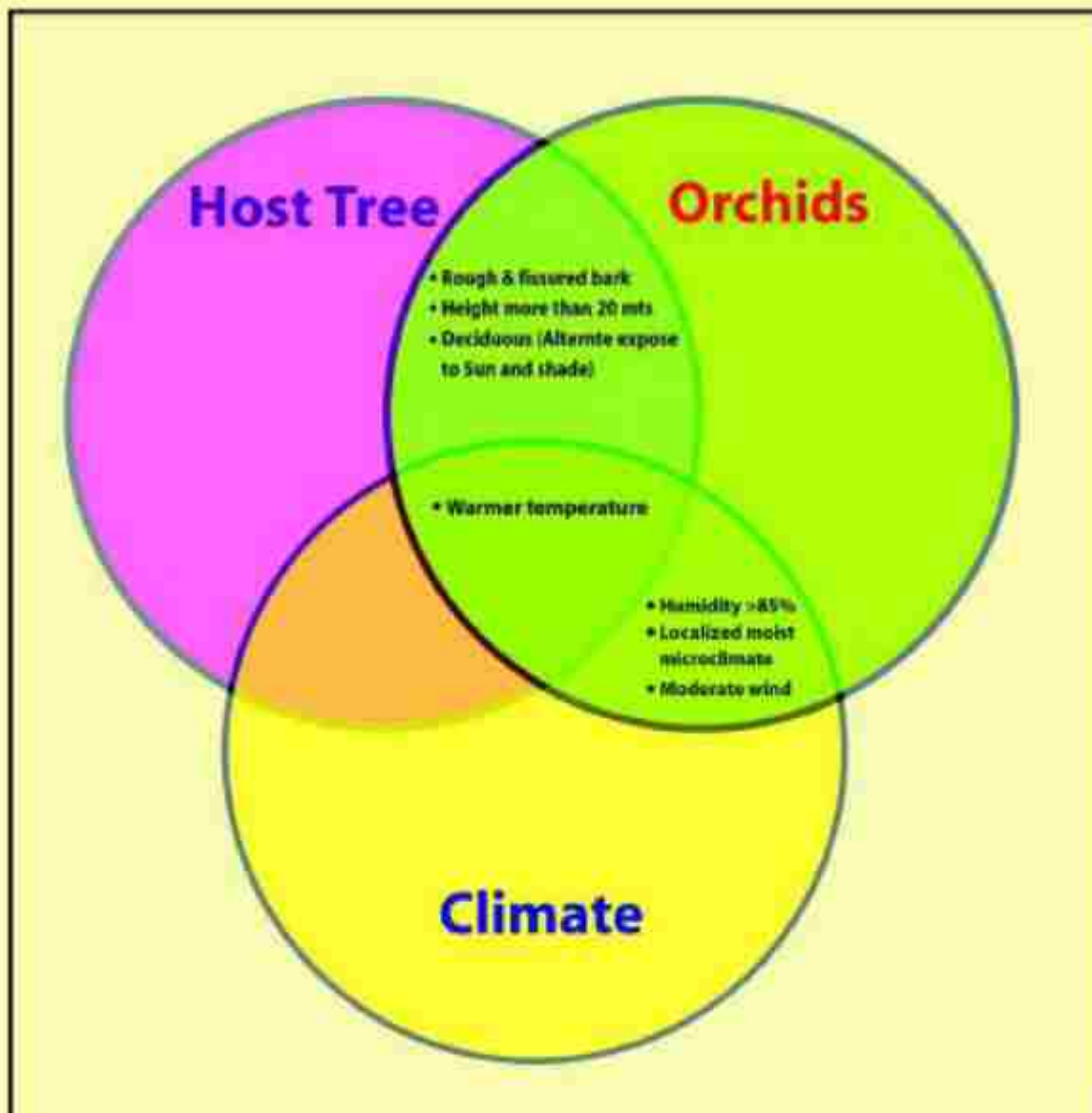
(a) climate;

(b) topography;

(c) characteristics of host trees; and

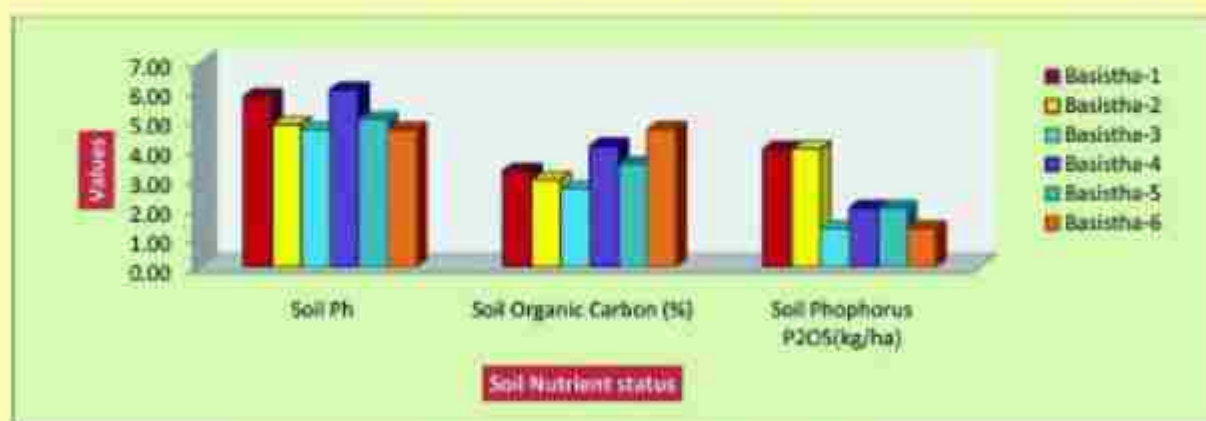
(d) sustenance of epiphytic orchids-

in a particular ecosystem. The indicator of this complex dynamics can be observed in the plot where there is a localized development of humid micro climate due to transpiration of moisture by host trees as well as epiphytic orchids.



V-4. Venn diagram showing epiphytic orchid and host tree relationship dynamics

7.4.8.1.6 Terrestrial orchids: Only one terrestrial orchid was identified sporadically in the orchid study plot i.e. *Malaxis sp.* The reason behind less diversity of terrestrial orchids might be due to the vegetation i.e. dominantly Teak trees. Due to the broad leaves of the teak trees, the top soil is washed off by dripping and thus less fertile which is evident from the soil analysis report where it is seen that the organic carbon content (2.66 - 4.12%) is less as compared to other plots where terrestrial orchid species grow. The phosphorus content is also low (1.307- 4.014 kg/ha) and the potash content is medium (224.45-493.25 kg/ha). The pH of the soil is found to be slightly acidic i.e. 4.67-6.03.



B-15 Graphical representation of Soil Nutrient Status



B-16 Graphical representation of Soil Potassium (K₂O) Status

7.4.9 Statistical analysis : Statistical analysis of the data obtained was carried out to determine the statistical significance of data, richness of biodiversity and extent of biodiversity with respect to epiphytic orchids and host trees. Here p value, Shannon-Weiner Diversity index and Biodiversity analysis were calculated using MS-Excel. The details of the result is shown below :

Table IV (1)

OBSERVED VALUE OF BASISTHA PLOT	Teak	Sal	Makri soil	Bajjaw	Total
<i>Acanpe multiflora</i>	2				2
<i>Aerides multiflora</i>	3				3
<i>Aerides odorata</i>	29	1			30
<i>Bulbophyllum careyanum</i>		1	2	1	4
<i>Cymbidium aloifolium</i>	9	12	2		23
<i>Dendrobium aphyllum</i>	3				3
<i>Rhynchosstylis retusa</i>	3				3
<i>Yanda teres</i>	20				20
Total	69	14	4	1	88

Total number of observations = 88

Table IV(2)

p0	LNp0	p0*LNp0	H	Hmax0	ORCHID EQUITABILITY
0.023	-3.784	-0.086	1.63	2.08	0.78
0.034	-3.379	-0.115			
0.341	-1.076	-0.367			
0.045	-3.091	-0.141			
0.261	-1.342	-0.351			
0.034	-3.379	-0.115			
0.034	-3.379	-0.115			
0.227	-1.482	-0.337			

Orchid equitability = 0.78

Table IV(3)

N*(N-1) (Orchids)	n*(n-1)	ORCHID BIODIVERSITY
7656	2	4.28
	6	
	870	
	12	
	506	
	6	
	6	
	380	
	1788	

Orchid biodiversity = 4.28

Table IV(4)

pHT	LNpHT	pHT*LNpHT	H	HmaxHT	HOST TREE EQUITABILITY
0.78	-0.24	-0.19	0.67	1.39	0.49
0.16	-1.84	-0.29			
0.05	-3.09	-0.14			
0.01	-4.48	-0.05			

Host tree equitability = 0.49

Table IV(5)

N*(N-1) (Host Tree)	n*(n-1)	BIODIVERSITY Y HOST TREE
7656	4692	1.57
	182	
	12	
	0	
	4886	

Host tree biodiversity = 1.57

Table IV(6)

t-Test: Two-Sample Assuming Unequal Variances	ORCHID	HOST TREE
Mean	11	22
Variance	129.71	1012.67
Observations	8	4
df	3	
t Stat	-3.11	
P(T<=t) one-tail	0.0265	
t Critical one-tail	2.35	
P(T<=t) two-tail	0.0530	
t Critical two-tail	3.18	

p - value (one tailed) = 0.0265

p - value (two tailed) = 0.0530

From the above tables, Table IV (2) and IV(3), it is clear that the epiphytic orchid diversity in Garbhanga study plot is low showing a value of 4.28 with a high equitability value of 0.78. In case of host trees, this plot shows very less diversity and equitability of 1.57 and 0.49 respectively, which is clearly shown in Table IV (4) and Table IV(5). This plot is a teak plantation which has resulted in a less diversity of host tree diversity value. In respect to statistical significance, Table IV(6) shows that the p - value for one tailed lies below 0.05 which means that the data collected are statistically significant. The two tailed p-value is slightly higher than 0.05 which is negligible.

Photographs of orchids collected from Garbhanga Study Plot



Bulbophyllum careyanum



Vanda teres



Cymbidium aloifolium



Rhynchostylis retusa



Dendrobium aphyllum



Aerides odorata



Aerides multiflora



Acampe multiflora



Aerides odorata (Plant)

7.5 Plot 5, Kholahat RF, Nagaon Division under Amsol Silviculture Range

7.5.1 Location:

The plot is situated at around 70 kms (approx.) by road from Guwahati under Dharamtul Territorial Range falling within Kholahat RF under Nagaon Division.



7.5.2 Physiography:

The plot is lying on the plain areas with nominal slope ranging from 5-10% and an average south western aspect.

7.5.3 Forest type:

The orchid study area belongs to Moist Deciduous Forests. The area is dominated by tree species like Ajhar, Bhefu, Sal, Jamun, Paroli, Gomari, etc. The top storey is covered by Sal, Paroli, Makri, Sal, Poma, etc. The middle storey is comprised of Hilika, Sotiona, Bandor Dima, Sida, etc. and the lower storey comprises of Kanchan, Baji Du, Dudhkuri, etc.

The ground cover is found to be of Keturi, Tora pat, MakhI loti, Bhedai Lota, and Clerodendron, Wild ginger, Dhekia etc.

(Source: Working Plan of Nagaon Division)

7.5.4 Forest density:

The plot falls in the area where canopy density is 40-60%

7.5.5 Soil: In the orchid study plot, the soil is of loamy to clayey to alluvial origin. The alluvial soil is mostly loamy and consists of a mixture of clay and sand in varying proportions.

(Source: Working Plan of Nagaon Division)

7.5.6 Date of collection of Data: From 9th Aug'2021 to 11th Aug'2021

Data collection team

- Sri Sailen Das, AFS, Silviculturist, Assam
- Smt. Himamoni Handique, Research Officer
- Sri Hitesh Das, Fr-I I/c R.O. Amsol Silviculture Range.
- Assisted by staffs of Amsol Silviculture Range and labourers.

7.5.7. Data collected during field survey

7.5.7.1. Local atmospheric data

- Temperature: 29.3-31°C
- Humidity: 91% (Rainy day)
- Average soil temperature: 29.1°C-30°C (soil temperature recorded from 1 ft below the earth surface)

7.5.7.2 Enumeration and marking of trees bearing orchids:

All the orchid bearing trees were marked by painting and numbering by white paint. Statement of collection of enumeration is furnished in Appendix-V.

7.5.7.3 Rehabilitation of orchids: A total number of 3 species of wind fallen orchids were rehabilitated in living trees by tying them with coconut rope.

7.5.7.4 Procedure followed to identify epiphytic and terrestrial orchids

7.5.7.4.1 On spot identification: The morphology of the orchids was minutely observed and flowering pattern was studied in case of blooming orchids which are listed below:

Table-16 Orchids identified on-spot

Sl. No.	English Name/Local Name	Scientific name
1.	Aloe-leafed cymbidium	<i>Cymbidium aloifolium</i> (L) Sw.
2.	Carey's Bulbophyllum	<i>Bulbophyllum careyanum</i> (Hook) spreng
3.	Brittle orchid	<i>Acampe praemorsa</i> (Roxb)
4.	Stiff acampe	<i>Acampe multiflora</i> (Lindl) Lindl
5.	Terete vanda	<i>Papilionanthe teres</i> (Roxb.) Schltr.
6.	Mann's phalaenopsis	<i>Phalaenopsis manni</i> Rchb.f.
7.	Hooded Orchids	<i>Dendrobium aphyllum</i> (Roxb)

7.5.7.5 Soil sample collection: The soil samples were collected from different locations according to standard procedure as laid down in point 5.4 and were sent to District Agricultural Office, Ulubari for macro nutrient analysis of the soil.

7.5.8 Data analysis & Result

7.5.8.1 Factors attributable: The following attributes were found responsible to derive an inference on natural orchid propagation and its behavior with relation to the existing ecosystem.

- Forest type
- Forest density
- Physiography
- Climate
- Species diversity
- Soil temperature and characteristics

7.5.8.1.1 Forest type: Since the plot falls under Moist Deciduous Forests, warm temperature (29.3-31°C) and high relative humidity (91%) are characteristic features of these forests.

7.5.8.1.2 Forest density: The plot is almost uniformly covered with dense forest. The dominated tree species are Ajhar, Sal, Jamuk, Gomari, etc. (refer Appendix-V).

7.5.8.1.3 Physiography: The plot lies on the plains with an average South western aspect and the epiphytic orchids were uniformly distributed throughout the entire plot. Therefore, physiography doesn't have any impact on the species distribution of orchids.

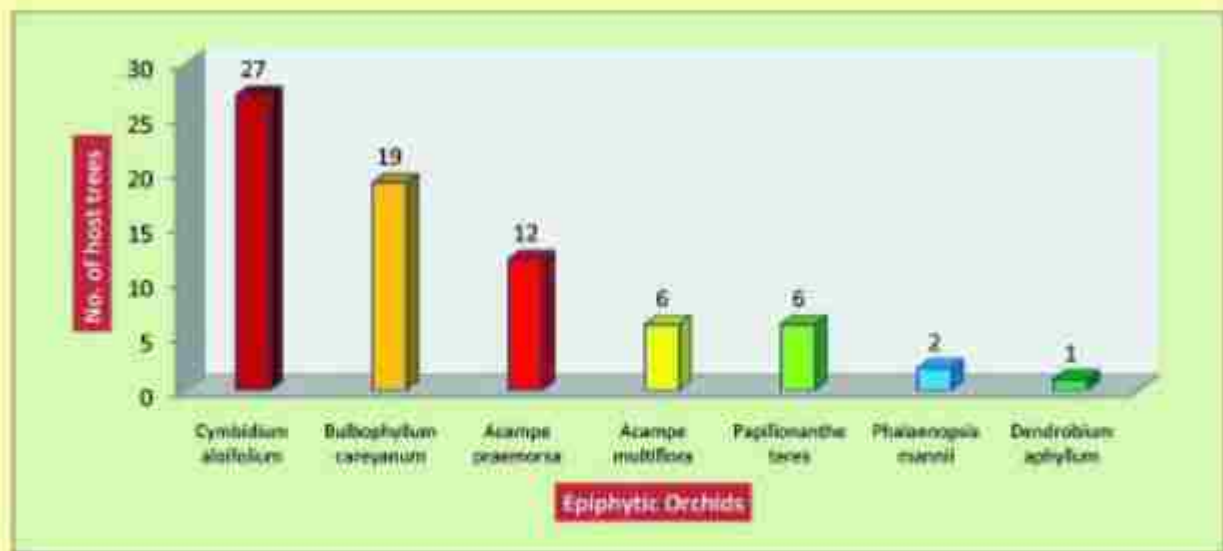
7.5.8.1.4 Climate: The climate is characterized by the excessive humidity in the air and the rise of temperature is checked by frequent showers and thunderstorms. The change of season is therefore not marked by the extreme contrasts of temperature and humidity. The annual rainfall, on an average varies from 1500 mm to 2600 mm. Showers are generally distributed over all the months of the year. The month of July receives the highest amount of rainfall. The month of December receives the lowest rainfall.

(Source: Working Plan of Nagoan Division).

7.5.8.1.5 Species diversity in epiphytic orchids: After analyzing the raw data from Appendix V, an effort was made to establish a correlation between host trees and the epiphytic orchid species. An indicative correlation between them is furnished below:

Table 17. Epiphytic orchids with Host trees

Sl. No.	Name of epiphytic orchid species		Number of host trees associated	Host tree species
	English/Local Name	Scientific name		
1	Aloe-leaved cymbidium	<i>Cymbidium aloifolium</i> (L.) Sw.	27	Gomari, Bhelu, Sal, Ajhar, Oxy, Jamuk, Paroli, Hilikha.
2	Carey's Bulbophyllum	<i>Bulbophyllum careyanum</i> (Hook) spreng	19	Bhelu, Sal, Barun, Ajhar, Jamuk, Sidha,
3	Brittle orchid	<i>Acampe praemorsa</i> (Roxb)	12	Paroli, Kuhir, Bhelu, Ajhar, Sal, Jamuk, Sal.
4	Stiff acampe	<i>Acampe multiflora</i> (Lindl) Lindl	6	Ajhar, Paroli, Jamuk, Bhelu, Barun
5	Terete vanda	<i>Papilionanthe teres</i> (Roxb.) Schltr.	6	Ajhar, Bhelu, Sal, Barun.
6	Mann's phalaenopsis	<i>Phalaenopsis mannii</i> Rechb.f.	2	Ajhar.
7	Hooded Orchids	<i>Dendrobium aphyllum</i> (Roxb)	1	Ajhar



B-17. Graphical representation showing correlation of epiphytic orchids with host trees

Table 17 depicts the abundance of different types of epiphytic orchids in the plot out of which 3(three) species of epiphytic orchids viz. Aloe-leaved cymbidium (*Cymbidium aloifolium*), Carey's Bulb-leaf Orchid (*Bulbophyllum careyanum*) and Brittle Orchid (*Acampe praemorsa*) are seen growing on various host trees ranging from minimum of 12 to maximum of 27 species.

From field study and other publication resources, it was found that the following factors might have triggered the growth of the epiphytic orchids in the plot: -

Climate:

As per study and field observations it may be stated that the growth of all the aforesaid epiphytic orchids require some specific climatic requirements such as;

- *Cymbidium aloifolium* requires warm and humid climate in their growing period i.e. 20-24 °C and cool climate in flowering seasons i.e. 10-20°C. They prefer light shade from the midday sun and relative humidity of 50-80%.
- *Bulbophyllum careyanum* grows well at temperature range of 12-25 °C and 60% Relative Humidity for their growth.
- *Acampe praemorsa* is a hot to cool growing orchid requiring intermediate to warm temperature and full sunlight for its growth.

Host tree characteristics:

The second most important requirement for the growth of the epiphytic orchids is the characteristics of the host trees. B-17 depicts that

- *Cymbidium aloifolium* is growing abundantly in 27 nos of host tree species.
- *Bulbophyllum careyanum* is growing in 19 nos of host tree species.
- *Acampe praemorsa* is growing in 12 nos. of host tree species.

It is observed that all the host tree species are semi-deciduous to deciduous with little to medium sized leaves.

Wind :

All the epiphytic orchids need moderate wind flow for the transportation of pollen essential for their propagation as well as air movement and ventilation during their entire growing period. This condition is satisfied when the tree height is more than 15 metres.

Bark characteristics:

The bark of the host trees is another most important feature which determines the suitability of the orchids to establish and propagate in a particular tree species. Generally orchids prefer fissured bark/rough bark surface for clinging into the tree trunk for natural regeneration.

Table 18. Host trees with epiphytic orchid species

Sl. No.	Name of host tree species		Number of epiphytic orchid species associated	Epiphytic orchid species
	English/Local Name	Scientific name		
1	Ajhar	<i>Lagerstroemia speciosa</i> (L.) Pers	7	<i>Cymbidium aloifolium</i> , <i>Acampe multiflora</i> , <i>Papilionanthe teres</i> , <i>Acampe praemorsa</i> , <i>Bulbophyllum careyanum</i> , <i>Dendrobium aphyllum</i> , <i>Phalaenopsis manii</i>
2	Bhelu	<i>Trewia nudiflora</i> L.	5	<i>Cymbidium aloifolium</i> , <i>Bulbophyllum careyanum</i> , <i>Acampe praemorsa</i> , <i>Papilionanthe teres</i> , <i>Acampe multiflora</i>
3	Sal	<i>Shorea robusta</i> Roth	4	<i>Bulbophyllum careyanum</i> , <i>Cymbidium aloifolium</i> , <i>Papilionanthe teres</i> , <i>Acampe praemorsa</i>
4	Jamuik	<i>Syzygium cumini</i> (L.) Skeels	4	<i>Acampe multiflora</i> , <i>Bulbophyllum careyanum</i> , <i>Cymbidium aloifolium</i> , <i>Acampe praemorsa</i>
5	Barun	<i>Crateva magna</i> (Lour.) DC	3	<i>Acampe multiflora</i> , <i>Bulbophyllum careyanum</i> , <i>Papilionanthe teres</i>
6	Paroli	<i>Stereospermum chelonoides</i> DC	3	<i>Acampe multiflora</i> , <i>Acampe praemorsa</i> , <i>Cymbidium aloifolium</i>
7	Gomari	<i>Gmelina arborea</i> Roxb	1	<i>Cymbidium aloifolium</i>
8	Hilikha	<i>Terminalia chebula</i> Retz	1	<i>Cymbidium aloifolium</i>
9	Kuhir	<i>Bridelia retusa</i> (L.) A.Juss	1	<i>Acampe praemorsa</i>
10	Oxy	<i>Dillenia pentagyna</i> Roxb	1	<i>Cymbidium aloifolium</i>
11	Sidha	<i>Lagerstroemia speciosa</i> (L.) Pers	1	<i>Bulbophyllum careyanum</i>



B-18. Graphical representation showing correlation of host trees with epiphytic orchids

From Table 18, it is evident that 4 (four) species of host trees viz. Azar, Bhelu, Sal and Jamun are found to host diverse species of epiphytic orchids out of 8 epiphytic orchid species identified. All the host tree species are seen to host 7, 5, 4 and 4 species of epiphytic orchids respectively.

From the field study as well as other publication resources, it was found that the trees in these forests bear the following characteristics which makes them suitable for harbouring different species of epiphytic orchids.

• **Height of the tree:**

The height of the tree plays an important role in the growth of the epiphytic orchids especially the light demanding ones. It is observed that the host trees bearing height above 15 metres host maximum orchids as they help the epiphytic orchids to fetch adequate amount of sunlight required for their growth. It is evident from the field that the host trees Azar, Bhelu, Sal and Jamun are seen to host maximum epiphytic orchid species as their average heights are 20-25 mts, 15-20 mts and 30-35 mts respectively.

• **Bark characteristics:**

In this plot, the bark of the host trees bearing the epiphytic orchids is mostly of rough texture with longitudinal fissures. This rough textured bark helps in establishment of the epiphytic orchids.

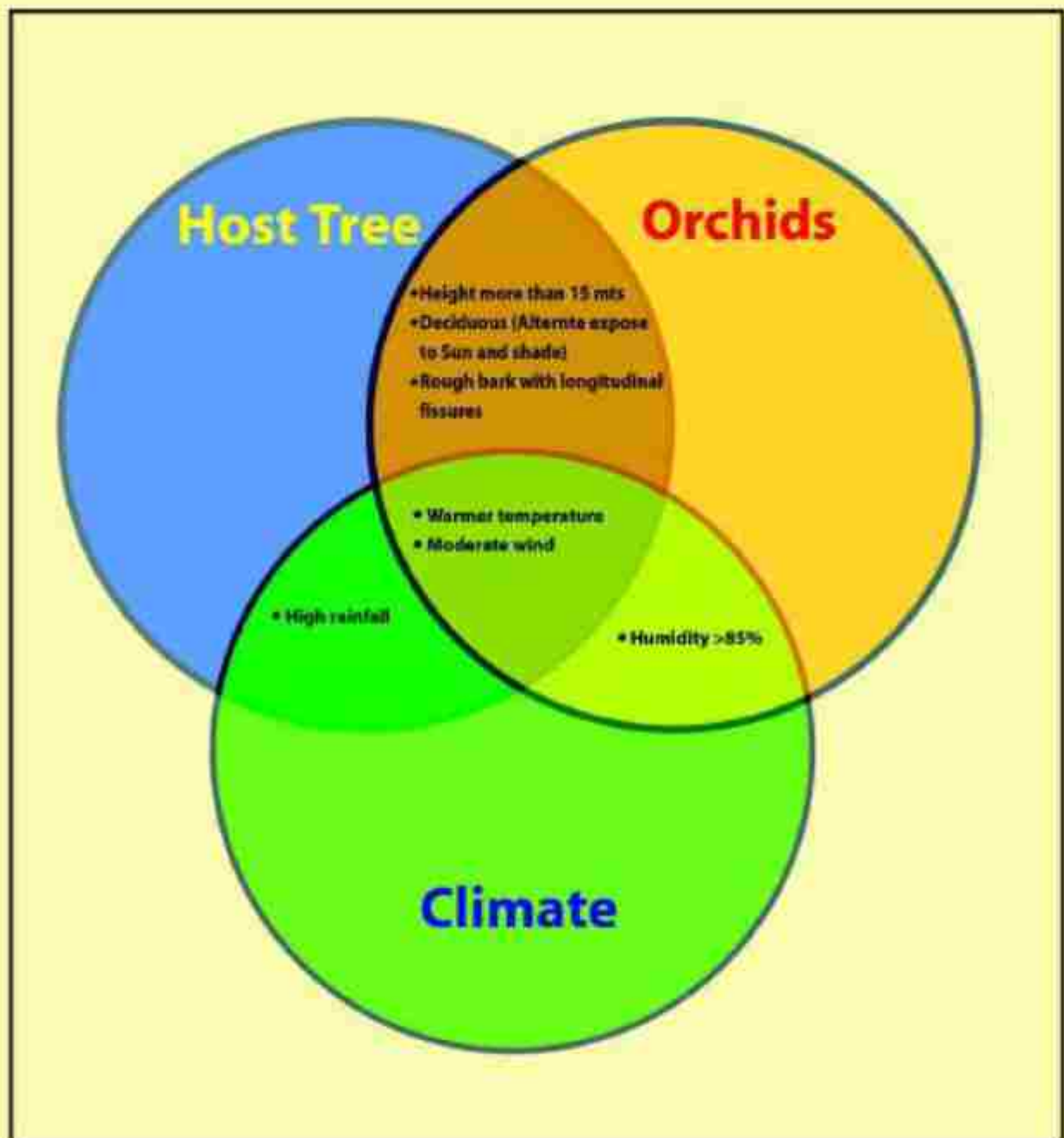
• **Leaf characteristics:**

The host tree species bearing the epiphytic orchids are mostly semi-deciduous to deciduous. This clearly depicts that the epiphytic orchids growing in these host trees require full sun during a particular phase of their growth period.

Rest of the epiphytic orchids and host trees have a lesser affinity towards each other due to reduced matching with respect to preference of the epiphytic orchids and the characteristics of the host trees. It may be inferred that there is a direct and indirect correlation among

- (a) climate;
- (b) wind;
- (c) characteristics of host trees; and
- (d) sustenance of epiphytic orchids-

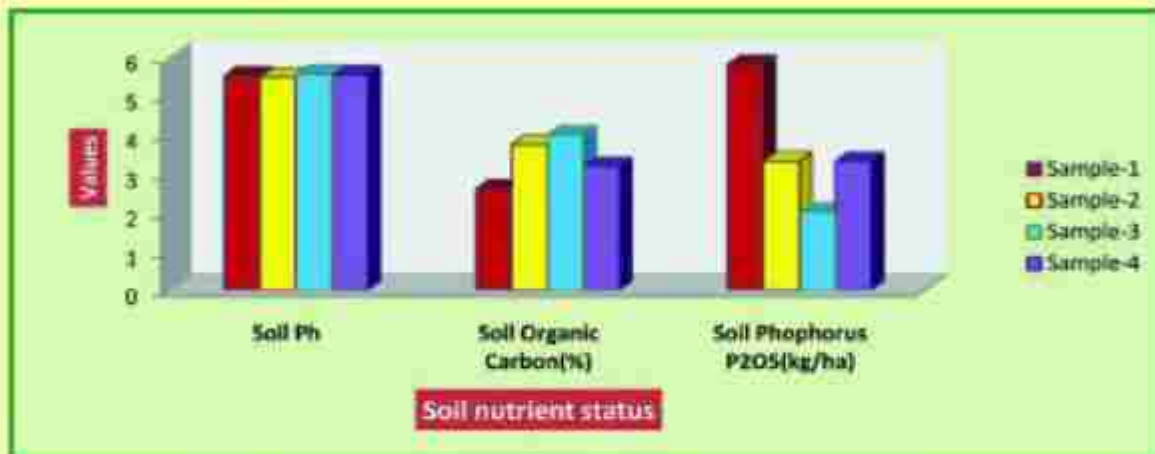
in this particular ecosystem. The indicator of this complex dynamics can be observed in the plot where there is a localized development of humid micro climate due to transpiration of moisture by host trees as well as epiphytic orchids.



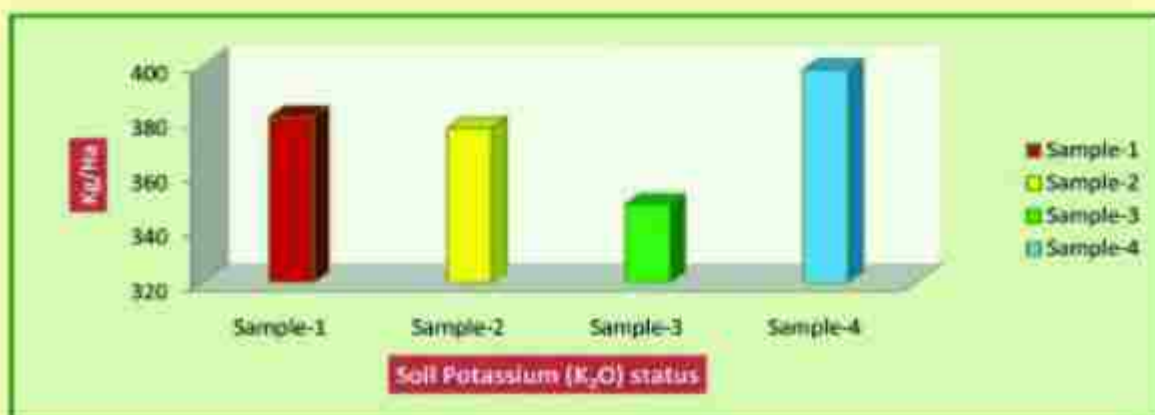
V-5. Venn diagram showing epiphytic orchid and host tree relationship dynamics

7.5.9. Soil analysis :

The test results of the soil analysis reveal that the average organic carbon content of the plot ranges from 2.60- 4.00 %, phosphorus content ranges from 2.006-5.805 kg/ha and potash content ranges from 348.63-398.23 kg/ha. The average soil pH of the plot ranges from 5.47-5.55 which is slightly acidic.



B-19. Graphical representation showing soil nutrient status



B-20. Graphical representation showing Soil Potassium (K₂O) status

7.5.10. Statistical analysis :

Statistical analysis of the data obtained was carried out to determine the statistical significance of data, richness of biodiversity and extent of biodiversity with respect to epiphytic orchids and host trees. Here p value, Shannon-Weiner Diversity index and Biodiversity analysis were calculated using MS-Excel. The details of the result is shown below

Table Y(1)

OBSERVED VALUE OF AMSOI PLOT	Ajhar	Barun	Bhele	Gomari	Hilisha	Jamuk	Kuhir	Oxy	Pareli	Sol	Sidha	Total
<i>Acampe multiflora</i>	2	1	1			1			1			6
<i>Acampe prunmaria</i>	4		1			1	1		3	2		12
<i>Bulbophyllum careyanum</i>	4	1	2			3				8	1	19
<i>Cymbidium alofolium</i>	2								1	1		4
<i>Cymbidium pendulum</i>	3		4	2	1	4		1		8		23
<i>Dendrobium aphyllum</i>	1											1
<i>Papilionantha tora</i>	3											3
<i>Phalaenopsis</i>	2											2
Total	21	2	8	2	1	9	1	1	5	19	1	70

Total number of observations = 70

Table V(2)

p0	LNp0	p0*LNp0	H	Hmax	ORCHID EQUITABILITY
0.09	-2.46	-0.21	1.69	2.08	0.81
0.17	-1.76	-0.30			
0.27	-1.30	-0.35			
0.06	-2.86	-0.16			
0.33	-1.11	-0.37			
0.01	-4.25	-0.06			
0.04	-3.15	-0.13			
0.03	-3.56	-0.10			

Orchid equitability = 0.81

Table V(3)

N*(N-1) (Orchids)	n*(n-1)	ORCHID BIODIVERSITY
4030	30	4.69
	132	
	342	
	12	
	506	
	0	
	6	
	2	
	1030	

Orchid biodiversity = 4.69

Table V(4)

pHT	LNpHT	pHT*LNpHT	H	Hmax	HOST TREE EQUITABILITY
0.30	-1.20	-0.36	1.86	2.40	0.78
0.03	-3.56	-0.10			
0.11	-2.17	-0.25			
0.03	-3.56	-0.10			
0.01	-4.25	-0.06			
0.13	-2.05	-0.26			
0.01	-4.25	-0.06			
0.01	-4.25	-0.06			
0.07	-2.64	-0.19			
0.27	-1.30	-0.35			
0.01	-4.25	-0.06			

Host tree equitability = 0.78

Table V(5)

N*(N-1) (Host Trees)	n*(n-1)	HOST TREE BIODIVERSITY
4030	420	5.28
	2	
	56	
	2	
	0	
	72	
	0	
	0	
	20	
	342	
	0	
	914	

Host tree biodiversity = 5.28

Table V(6)

t-Test: Two-Sample Assuming Unequal Variances	ORCHID	HOST TREE
Mean	9	6
Variance	69.64	53.85
Observations	8	11
df	14	
t Stat	-4.78	
P(T<=t) one-tail	0.0001	
t Critical one-tail	1.76	
P(T<=t) two-tail	0.0003	
t Critical two-tail	2.14	

p- value (one tailed) = 0.0001

p- value (two tailed) = 0.0003

Table V (2) and Table V (3) depicts that the epiphytic orchid diversity in Kholahat study plot is low showing a value of 4.69 whereas the equitability is on a higher side with value of 0.81. In case of host tree biodiversity, this plot shows moderate diversity of 5.28 and a higher equitability value of 0.78 which is clearly shown in Tables V (4) and Table V (5). In respect to statistical significance, Table III(6) shows that the p value for both one tailed and two tailed lies below 0.05 which means that the data collected are statistically significant.

Photographs of orchids collected from Kholahat Study Plot



Rhynchostylis retusa



Dendrobium aphyllum



Vanda teres



Acampe praemorsa



Bulbophyllum careyanum



Acampe multiflora



Phalaenopsis mannii



Papilionanthe teres



Cymbidium aloifolium

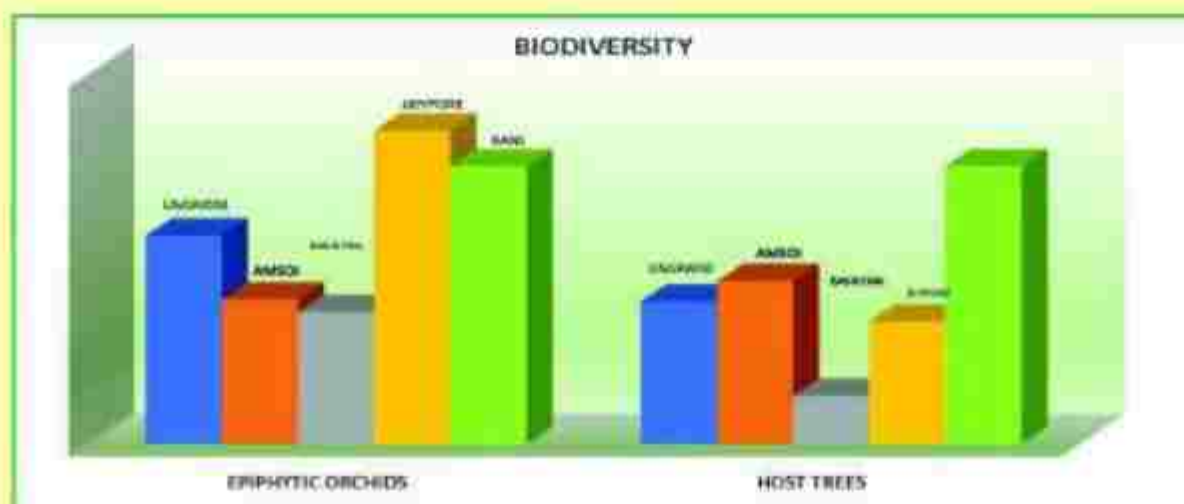
B. COMPARATIVE STUDY OF EXTENT OF BIODIVERSITY OF ORCHIDS, ITS RICHNESS AND THEIR RELATIONSHIP WITH THE EXISTING ECOSYSTEM WITH RESPECT TO 5 (FIVE) NOS. OF PLOTS IN DIFFERENT FOREST TYPE AREAS.

Detailed comparative study has been carried out from the inferences out of plot wise study and the result of which is furnished as below :

- ❖ **Extent of biodiversity** The extent of biodiversity is calculated and shown in the Table 19 and char B-21.

Table 19. COMPARISON OF BIODIVERSITY OF ORCHIDS & HOST TREES IN 5 PLOTS

BIODIVERSITY	UMJAKINI	AMSOI	BASISTHA	JEYPORE	RANI
EPIPHYTIC ORCHIDS	6.76	4.69	4.28	10.17	9.01
HOST TREES	4.63	5.28	1.57	3.97	4.44



B-21. Graphical representation showing extent of biodiversity in 5 study plots

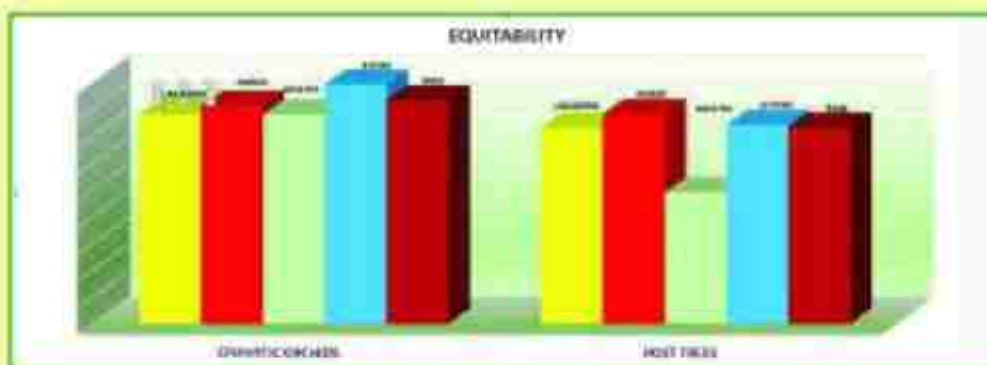
From the chart above, a comparison between existing biodiversity of epiphytic orchids and their host trees can be observed where a higher diverse epiphytic orchids is available in Jeypore and Rani plots whereas Basistha and Amsoi plots are having low biodiversity of orchids. However Umjakhini plot is showing a moderate biodiversity of orchids. Similarly Rani plot is rich with diverse species of host trees whereas Basistha plot has poor diversity of host trees as this plot is covered mostly by Teak plantation. Umjakhini, Amsoi and Jeypore plots are showing moderate biodiversity of host trees.

- ❖ **Equitability**

Table 20. COMPARISON OF EQUITABILITY OF ORCHIDS & HOST TREES IN 5 PLOTS

EQUITABILITY	UMJAKINI	AMSOI	BASISTHA	JEYPORE	RANI
EPIPHYTIC ORCHIDS	0.78	0.81	0.78	0.89	0.83
HOST TREES	0.73	0.78	0.49	0.74	0.73

From the Table 20, a comparative representation of species equitability chart has been prepared.



B-22. Graphical representation showing species equitability in 5 study plots

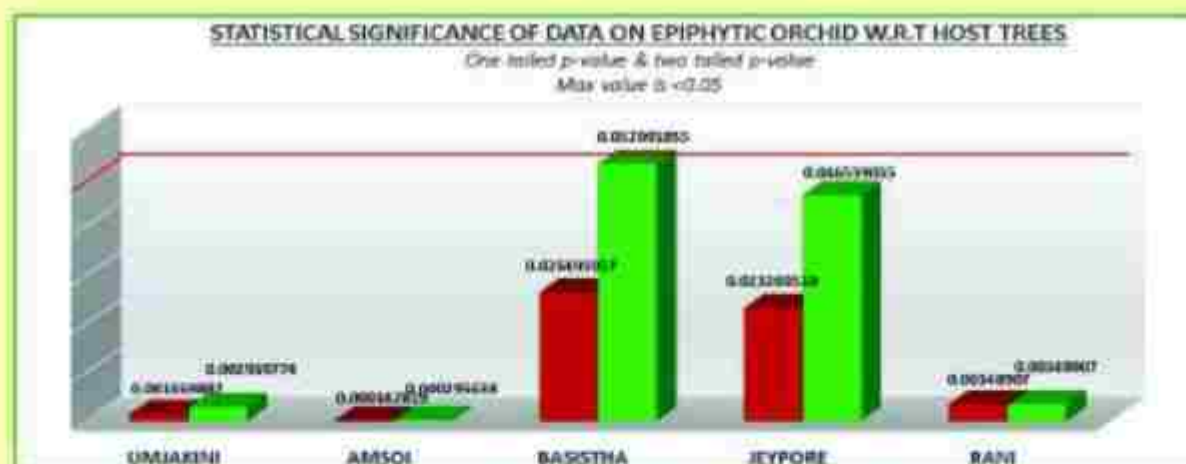
Almost all the 5 plots are equally rich with diversity of epiphytic orchids in terms of representation of orchid species availability whereas equitability of host trees concerned other than Basistha, all the 4 plots are enriched with moderate to high richness of host trees.

❖ **Statistical significance of data**

Table 21. COMPARISON OF P-VALUE FOR DETERMINING STATISTICAL SIGNIFICANCE OF DATA COLLECTED W.R.T EPIPHYTIC ORCHIDS IN 5 PLOTS

p-VALUE	UMJAKINI	AMSOI	BASISTHA	JEYPORE	RANI
ONE TAILED	0.0015	0.0001	0.0265	0.0233	0.0035
TWO TAILED	0.0029	0.0003	0.0530	0.0465	0.0035

From the Table21, statistical significance of data on epiphytic orchids with respect to host trees is calculated by evaluating one tailed p value and two tailed p value and a chart is prepared as follows:



B-23. Graphical representation showing statistical significance of data in 5 study plots

From the above chart, it is clear that one tailed p value and two tailed p value are lying below 0.05 (approx.) except marginal increase in Basistha plot which indicates that the categoric data collected are statistically significant.

After data analysis and subsequent interferences, a comparative study of orchids and its relationship dynamics with the ecosystem is carried out to derive the dependency on attributes responsible for the health and diverse growth of orchids. The parameters identified for this comparative study is as follows :

■ **Climate :**

It is the most important factor contributing to the growth of both epiphytic and terrestrial orchids. It is observed that the growth of epiphytic orchids is grossly influenced by orchid friendly climate i.e. warmer temperature, high rainfall with high humidity and moderate wind. The effect of these three parameters of the climate could be largely observed in the shape of high orchid biodiversity in Umjakhini, Jeypore and Rani. However, less equitable contribution of these factors in other two plots of Amsol and Panchakanya indicates low diversity of epiphytic orchids.

■ **Forest type :**

The Wet Evergreen Forests are most conducive for the growth of epiphytic as well as terrestrial orchids as it is evident in Jeypore orchid study plot under Forest type IB/CI. However, Rani and Umjakhini orchid study plots under Forest Types 3C/c 2d(ii), 2BC1/b, 2BC and 3C/C3b respectively are also not lagging behind by housing moderate to high epiphytic orchid biodiversity.

■ **Host tree characteristics :**

The condition of host tree characteristics is directly satisfied for the luxuriant growth of epiphytic orchids as seen in the plots of Rani and Umjakhini. However, though such characteristics are not offset by the host trees in the Jeypore orchid study plot directly but the growth of lichens and mosses on the bark created a favourable microhabitat for growth of orchids in the host trees. In the other two plots, less availability of host trees bearing required characteristics for flourishing growth of epiphytic orchids affected the biodiversity of epiphytic orchids.

■ **Soil :**

From the above chart, it is evident that the presence of high soil organic carbon, highly acidic soil and low phosphorus content is conducive for the growth of terrestrial orchids as observed in the orchid study plots of Jeypore and Umjakhini. The diverse growth of terrestrial orchids is not noticed in the plots. The probable cause may be outlined as :-

- ✓ Seasonal growth of terrestrial orchids
- ✓ Affect of anthropogenic factors
- ✓ Dense growth of ground vegetation
- ✓ Transitional phase during propagation of orchids' growth.
E.g. Identification of orchid species is difficult after the shedding of its capsule as observed in Garbhanga Orchid study plot which is clearly shown in Fig 6.



Fig 6. Shedding of capsule after maturity leading to difficulty in orchid identification in the field

- Distribution of orchids :** Out of 39 numbers of species of epiphytic orchids studied, following species of epiphytic orchids were found to be distributed in 4-5 numbers of plots over different forest type areas under study as furnished in the Table 22.

Table 22. Plot wise availability of epiphytic orchids

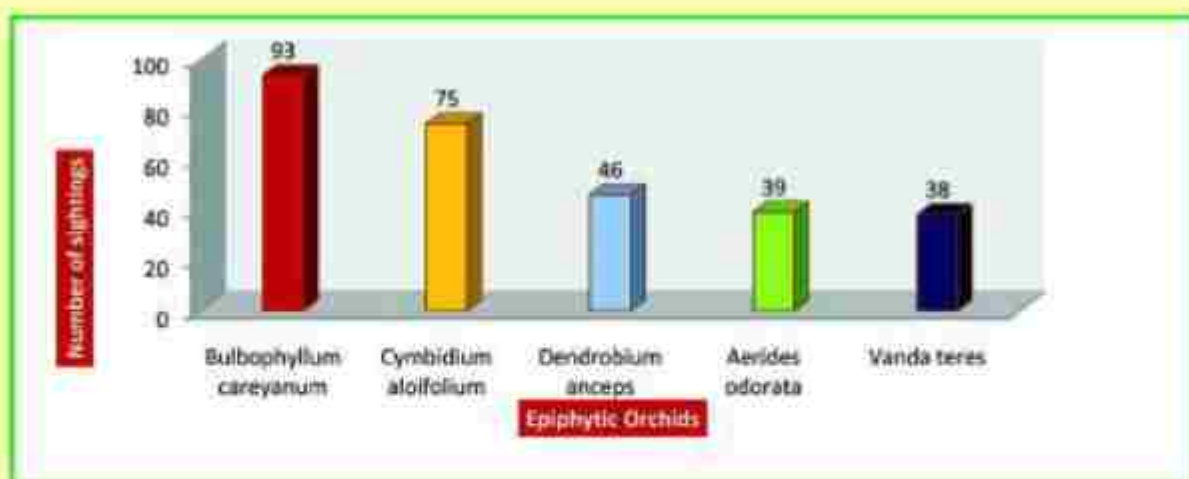
Sl No	Name of orchid species	Number of plots
1	<i>Cymbidium aloifolium</i>	5
2	<i>Bulbophyllum careyanum</i>	4
3	<i>Aerides odorata</i>	4
4	<i>Rhynchosstylis retusa</i>	4
5	<i>Dendrobium aphyllum</i>	4

- Endemicity :** After a study of distribution of epiphytic orchids from the collected data, some of the species are found to be endemic to a certain forest type. The epiphytic orchid species are restricted to a single forest type indicating their tendency towards endemicity, which is furnished in the Table below :

Table 23. Endemicity of epiphytic orchids in different forest types

Sl No	Name of orchid species	Forest type
1	<i>Pinolia pumila</i>	Moist Plain Sal Forests-Kamrup Sal
2	<i>Vanda coerulea</i>	Moist Semi-evergreen Forests
3	<i>Agrostophyllum planicaule</i>	Assam Valley Tropical Wet Evergreen Forests
4	<i>Pinolia bractescens</i>	Moist Semi-evergreen Forests
5	<i>Pelatantheria Insectifera</i>	Moist Plain Sal Forests-Kamrup Sal
6	<i>Papilionanthe teres</i>	Moist Deciduous Forests
7	<i>Bulbophyllum sikkimense</i>	Assam Valley Tropical Wet Evergreen Forests.
8	<i>Luisia sp</i>	Moist Semi-evergreen Forests
9	<i>Renanthera imschootiana</i>	Moist Semi-evergreen Forests
10	<i>Cymbidium bicolor</i>	Moist Plain Sal Forests-Kamrup Sal
11	<i>Bulbophyllum affine</i>	Assam Valley Tropical Wet Evergreen Forests
12	<i>Bulbophyllum roxburghii</i>	Assam Valley Tropical Wet Evergreen Forests
13	<i>Cleisostoma subulatum</i>	Assam Valley Tropical Wet Evergreen Forests
14	<i>Coelogyne sp</i>	Moist Semi-evergreen Forests
15	<i>Dendrobium densiflorum</i>	Moist Plain Sal Forests-Kamrup Sal
16	<i>Dendrobium lituiflorum</i>	Assam Valley Tropical Wet Evergreen Forests
17	<i>Dendrobium pierardii</i>	Moist Semi-evergreen Forests
18	<i>Eria lasiopetala</i>	Assam Valley Tropical Wet Evergreen Forests
19	<i>Gastrochilus dasypogon</i>	Assam Valley Tropical Wet Evergreen Forests
20	<i>Bulbophyllum hirtum</i>	Moist Semi-evergreen Forests
21	<i>Cymbidium dayanum</i>	Moist Semi-evergreen Forests
22	<i>Cymbidium pendulum</i>	Moist Semi-evergreen Forests
23	<i>Dendrobium macraei</i>	Moist Plain Sal Forests-Kamrup Sal
24	<i>Dendrobium nathanielis</i>	Moist Semi-evergreen Forests

- Abundance :** A comprehensive analysis of the data depicts that 6 (six) nos. of epiphytic orchids are mostly sighted during the field observations which indicates the abundant availability of above epiphytic orchids in their respective habitat. Graphical representation showing the abundance is illustrated below:



B-24 Graphical representation showing number of sightings of epiphytic orchids

Whereas, quite a number of epiphytic orchids are less sighted in all over forest type areas under study, tends to show their rarity in the existing ecosystems which is illustrated in the table below. E.g. *Rhynchosstylis retusa* which is known to be growing in almost all the forest type areas of Assam, but there were critically low sightings of this species during the field study. The probable reason of disappearance is its high market demand during the season when the whole plant is illegally removed from the host trees by the miscreants.

Table 24. Rarity of epiphytic orchids based on number of sightings

Sl No	Name of orchid species	Number of sightings
1	<i>Bulbophyllum hirtum</i>	1
2	<i>Cymbidium dayanum</i>	1
3	<i>Dendrobium nathaniells</i>	1
4	<i>Dendrobium macraei</i>	1

9. CONSTRAINTS

Though a sincere effort has been made to collect intensive data for analysis regarding orchid biodiversity and its relationship with the existing ecosystem but the effort was hindered by the following constraints-

9.1.1 Resource persons:

Very limited number of local resource persons in Assam with respect to the domain of the study selected.

9.2. Terrain:

Ease of movement and reaching out to identified host trees was difficult and time consuming.

9.3 Collection of quantitative data:

Counting of light demanding epiphytic orchids is not possible due to profuse clustered growth and remote height of orchid growth in the tree trunks.

9.4 Field identification of orchids:

Due to absence of high resolution binoculars, a substantial number of orchids could not be studied. e.g. Growth of *Dendrobium formosum* in the top canopies of Sal was difficult to observe. In addition to that, few orchids can't be identified until their flowering e.g. *Dendrobium fimbriatum* and *Dendrobium moschatum*, since their other

morphological features are almost same. Another example is different species of genus *Phalaenopsis*, which can be identified only after flowering.

10. RECOMMENDATION:

The study carried out was largely based on dynamics between growth of the epiphytic orchids and its ecosystem which is very general in character. However, it is recommended to carry out important species wise dynamism for in depth analysis if the department requires so.

From the field study, the sustenance of orchids are found to have been challenged (Ref Table - 24) given the fact that these orchids used to grow abundantly in this particular ecosystem. There is a scope of separate study/research to identify the factors responsible for this decline of growth probably due to change in ecosystem, biotic interference and climate change as there was no visible attributes observed during this field study.

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Appendix-I (Umjakhini Orchid Study Plot)

Sl No	Name of Orchid species found	Name of the Host tree		Remarks
		Local Name	Scientific Name	
1	<i>Coelogyne</i> sp	Jamun	<i>Syzygium cumini</i>	Epiphytic Orchid
	<i>Dendrobium acinaciforme</i> Sw			
	<i>Lubia</i> sp			
	<i>Vanda coerulea</i> Griff. ex. Lindl. <i>Pinalia bractescens</i> (Lindl.) Kuntze			
2	<i>Vanda coerulea</i> Griff. ex. Lindl.	Khasia Badam	NA	Epiphytic Orchid
3	<i>Vanda coerulea</i> Griff. ex. Lindl.	Khasia Badam	NA	Epiphytic Orchid
4	<i>Lubia</i> sp	Paroli	<i>Sterropermum chelonoides</i>	Epiphytic Orchid
	<i>Vanda coerulea</i> Griff. ex. Lindl.			
	<i>Renanthera imachotiana</i> Rolfe			
	<i>Dendrobium pierardii</i> R. Br.			
5	<i>Cymbidium dayanum</i> Rehb	Khasia Badam	NA	Epiphytic Orchid
6	<i>Coelogyne</i> sp	Makri Sal	<i>Schinus wallichii</i>	Epiphytic Orchid
	<i>Dendrobium acinaciforme</i> Sw			
7	<i>Renanthera imachotiana</i> Rolfe	Makri Sal	<i>Schinus wallichii</i>	Epiphytic Orchid
8	<i>Bulbophyllum hirtum</i> (Sw) Lindl ex. Wall.	Pine	<i>Pinus kashya</i>	Epiphytic Orchid
9	<i>Vanda coerulea</i> Griff. ex. Lindl.	Amlakhi	<i>Phyllanthus emblica</i>	Epiphytic Orchid
10	<i>Pinalia bractescens</i> (Lindl.) Kuntze	Serengpat		Epiphytic Orchid
	<i>Vanda coerulea</i> Griff. ex. Lindl.			
11	<i>Pholidota imbricata</i> Hook	Makri Sal	<i>Schinus wallichii</i>	Epiphytic Orchid
	<i>Dendrobium acinaciforme</i> Sw			
12	<i>Lubia</i> sp	Simatu	<i>Bombax ceiba</i>	Epiphytic Orchid
	<i>Renanthera imachotiana</i> Rolfe			
13	<i>Dendrobium acinaciforme</i> Sw	Paroli	<i>Sterropermum chelonoides</i>	Epiphytic Orchid
	<i>Vanda coerulea</i> Griff. ex. Lindl.			
	<i>Renanthera imachotiana</i> Rolfe			
	<i>Pinalia bractescens</i> (Lindl.) Kuntze			
14	<i>Dendrobium acinaciforme</i> Sw	Odal	<i>Sterculia colorata</i>	Epiphytic Orchid
	<i>Vanda coerulea</i> Griff. ex. Lindl. <i>Aerdis odorata</i> Lour			
15	<i>Renanthera imachotiana</i> Rolfe	Makri Sal	<i>Schinus wallichii</i>	Epiphytic Orchid
	<i>Pinalia bractescens</i> (Lindl.) Kuntze			
	<i>Dendrobium acinaciforme</i> Sw			
16	<i>Vanda coerulea</i> Griff. ex. Lindl.	Paroli	<i>Sterropermum chelonoides</i>	Epiphytic Orchid
17	<i>Pinalia bractescens</i> (Lindl.) Kuntze	Kutahi Jamak	<i>Syzygium fruticosum</i>	Epiphytic Orchid
18	<i>Renanthera imachotiana</i> Rolfe	Paroli	<i>Sterropermum chelonoides</i>	Epiphytic Orchid
19	<i>Pinalia bractescens</i> (Lindl.) Kuntze	Paroli	<i>Sterropermum chelonoides</i>	Epiphytic Orchid
20	<i>Renanthera imachotiana</i> Rolfe	Makri Sal	<i>Schinus wallichii</i>	Epiphytic Orchid
	<i>Vanda coerulea</i> Griff. ex. Lindl.			
21	<i>Dendrobium acinaciforme</i> Sw	Khasia Badam	NA	Epiphytic Orchid
	<i>Rhyncostylis retusa</i> (L) Blume			
22	<i>Dendrobium acinaciforme</i> Sw	Thengra		Epiphytic Orchid
	<i>Rhyncostylis retusa</i> (L) Blume			
23	<i>Vanda coerulea</i> Griff. ex. Lindl.	Jamun	<i>Syzygium cumini</i>	Epiphytic Orchid
24	<i>Vanda coerulea</i> Griff. ex. Lindl.	Thengra	NA	Epiphytic Orchid
	<i>Pinalia bractescens</i> (Lindl.) Kuntze			
25	<i>Lubia</i> sp	Thengra	NA	Epiphytic Orchid
26	<i>Coelogyne</i> sp	Makri Sal	<i>Schinus wallichii</i>	Epiphytic Orchid
27	<i>Vanda coerulea</i> Griff. ex. Lindl.	Makri Sal	<i>Schinus wallichii</i>	Epiphytic Orchid
28	<i>Lubia</i> sp	Odal		Epiphytic Orchid
	<i>Pinalia bractescens</i> (Lindl.) Kuntze			
29	<i>Vanda coerulea</i> Griff. ex. Lindl.	Thengra		Epiphytic Orchid
30	<i>Pinalia bractescens</i> (Lindl.) Kuntze	Makri Sal	<i>Schinus wallichii</i>	Epiphytic Orchid
	<i>Dendrobium acinaciforme</i> Sw			
31	<i>Vanda coerulea</i> Griff. ex. Lindl.	Makri Sal	<i>Schinus wallichii</i>	Epiphytic Orchid
	<i>Dendrobium acinaciforme</i> Sw			
32	<i>Vanda coerulea</i> Griff. ex. Lindl.	Makri Sal	<i>Schinus wallichii</i>	Epiphytic Orchid
33	<i>Dendrobium acinaciforme</i> Sw	Makri Sal	<i>Schinus wallichii</i>	Epiphytic Orchid
	<i>Vanda coerulea</i> Griff. ex. Lindl.			
	<i>Pinalia bractescens</i> (Lindl.) Kuntze			
	<i>Dendrobium nathanii</i> Rehb.F			
34	<i>Dendrobium acinaciforme</i> Sw	Makri Sal	<i>Schinus wallichii</i>	Epiphytic Orchid
	<i>Dendrobium fimbriatum</i> Hook			
35	<i>Cymbidium pendulum</i> (Roxb) Sw	Makri Sal	<i>Schinus wallichii</i>	Epiphytic Orchid
36	<i>Renanthera imachotiana</i> Rolfe	Thengra	NA	Epiphytic Orchid
	<i>Dendrobium acinaciforme</i> Sw			
37	<i>Vanda coerulea</i> Griff. ex. Lindl.	Gomari	<i>Gmelina arborea</i>	Epiphytic Orchid
38	<i>Pinalia bractescens</i> (Lindl.) Kuntze	Sirlu	<i>Albizia lebbek</i>	Epiphytic Orchid
	<i>Dendrobium pierardii</i> R. Br.			

	<i>Vanda coerulea</i> Griff. ex. Lindl.			
39	<i>Pholidota imbricata</i> Hook <i>Vanda coerulea</i> Griff. ex. Lindl.	Makri Sal	<i>Schinus wullichii</i>	Epiphytic Orchid
40	<i>Dendrobium actinociforme</i> Sw	Kundhuri		Epiphytic Orchid
41	<i>Coelogyne</i> sp <i>Dendrobium fibriatum</i> Hook	Makri Sal	<i>Schinus wullichii</i>	Epiphytic Orchid
42	<i>Pinalia bracteosus</i> (Lindl.) Kuntze <i>Pholidota rubra</i> Lindl.	Odai	<i>Sterculia colorata</i>	Epiphytic Orchid
43	<i>Vanda coerulea</i> Griff. ex. Lindl.	Makri Sal	<i>Schinus wullichii</i>	Epiphytic Orchid
44	<i>Dendrobium actinociforme</i> Sw <i>Pinalia bracteosus</i> (Lindl.) Kuntze	Makri Sal	<i>Schinus wullichii</i>	Epiphytic Orchid
45	<i>Vanda coerulea</i> Griff. ex. Lindl.	Makri Sal	<i>Schinus wullichii</i>	Epiphytic Orchid
46	<i>Rensanthera inschootiana</i> Rolfe	Makri Sal	<i>Schinus wullichii</i>	Epiphytic Orchid
47	<i>Vanda coerulea</i> Griff. ex. Lindl.	Makri Sal	<i>Schinus wullichii</i>	Epiphytic Orchid
48	<i>Vanda coerulea</i> Griff. ex. Lindl.	Makri Sal	<i>Schinus wullichii</i>	Epiphytic Orchid
49	<i>Vanda coerulea</i> Griff. ex. Lindl.	Makri Sal	<i>Schinus wullichii</i>	Epiphytic Orchid
50	<i>Dendrobium actinociforme</i> Sw <i>Coelogyne</i> sp	Makri Sal	<i>Schinus wullichii</i>	Epiphytic Orchid
51	<i>Rensanthera inschootiana</i> Rolfe <i>Dendrobium actinociforme</i> Sw	Makri Sal	<i>Schinus wullichii</i>	Epiphytic Orchid
52	<i>Rensanthera inschootiana</i> Rolfe	Makri Sal	<i>Schinus wullichii</i>	Epiphytic Orchid
53	<i>Pinalia bracteosus</i> (Lindl.) Kuntze	Makri Sal	<i>Schinus wullichii</i>	Epiphytic Orchid
54	<i>Anoectochilus roxburghii</i> (Wal.) Lindl.			Terrestrial Orchid found in some pockets.
55	<i>Tropidia</i> sp.			Terrestrial Orchid found in some pockets.
56	<i>Mussaia densiflora</i> (A. Rich) Kuntze			Terrestrial Orchid found in some pockets.

Appendix-II (Iyepore Orchid Study Plot)

Sl No	Name of the Orchid species found	Name of the host tree		Remarks
		Local Name	Scientific Name	
1	<i>Bulbophyllum careyanum</i> (Hook.) Spreng	Nabar	<i>Mesua ferrea</i> L.	Epiphytic Orchid
	<i>Clisostoma subulatum</i> Blum			
2	<i>Agrostophyllum planicaule</i> (Wall. ex Lindl.) Rchb.f.	Letaku	<i>Buccurea squida</i> (Roxb.) Müll-Arg.	Epiphytic Orchid
	<i>Gastrochilus diosypogon</i> (J.E.Sm.) Kuntze			
3	<i>Aerides odorata</i> Lour	Lewa	<i>Engelhardtia spicata</i>	Epiphytic Orchid
4	<i>Gastrochilus diosypogon</i> (J.E.Sm.) Kuntze	Morhal	<i>Vatica lanceifolia</i> Blume	Epiphytic Orchid
5	<i>Agrostophyllum planicaule</i> (Wall. ex Lindl.) Rchb.f.	Hollong	<i>Dipterocarpus retusus</i> Blume	Epiphytic Orchid
	<i>Rhynchosyris retusa</i> (L.) Blume			
6	<i>Aerides odorata</i> Lour	Morhal	<i>Vatica lanceifolia</i> Blume	Epiphytic Orchid
	<i>Dendrobium aplyllum</i> (Roxb.) C.E.C. Fisch.			
7	<i>Bulbophyllum careyanum</i> (Hook.) Spreng	Morhal	<i>Vatica lanceifolia</i> Blume	Epiphytic Orchid
	<i>Agrostophyllum planicaule</i> (Wall. ex Lindl.) Rchb.f.			
8	<i>Bulbophyllum careyanum</i> (Hook.) Spreng	Morhal	<i>Vatica lanceifolia</i> Blume	Epiphytic Orchid
	<i>Eria hastipetala</i> (Willd.) Ormerod			
9	<i>Bulbophyllum careyanum</i> (Hook.) Spreng	Morhal	<i>Vatica lanceifolia</i> Blume	Epiphytic Orchid
	<i>Rhynchosyris retusa</i> (L.) Blume			
10	<i>Cymbidium alofolium</i> (L.) Sw.	Pantoot	<i>Gluchidion arborescens</i> Bl.	Epiphytic Orchid
	<i>Bulbophyllum careyanum</i> (Hook.) Spreng			
11	<i>Cymbidium alofolium</i> (L.) Sw.	Mekai	<i>Shorea assamica</i> Dyer	Epiphytic Orchid
	<i>Agrostophyllum planicaule</i> (Wall. ex Lindl.) Rchb.f.			
12	<i>Eria hastipetala</i> (Willd.) Ormerod	Barpat	<i>Ailanthus grandis</i> Prain	Epiphytic Orchid
	<i>Cymbidium alofolium</i> (L.) Sw.			
13	<i>Pholidota imbricata</i> (Roxb.) Lindl.	Hollong	<i>Dipterocarpus retusus</i> Blume	Epiphytic Orchid
	<i>Cymbidium alofolium</i> (L.) Sw.			
14	<i>Bulbophyllum roxburghii</i> (Lindl.) Rchb.f.	Hollong	<i>Dipterocarpus retusus</i> Blume	Epiphytic Orchid
	<i>Dendrobium moschatum</i> Sw			
15	<i>Bulbophyllum affine</i> Wall. ex Lindl.	Hangari	<i>Guzonopsis indica</i> (Roxb. ex Lindl.) A.D.C.	Epiphytic Orchid
	<i>Bulbophyllum careyanum</i> (Hook.) Spreng			
16	<i>Agrostophyllum planicaule</i> (Wall. ex Lindl.) Rchb.f.	Hollong	<i>Dipterocarpus retusus</i> Blume	Epiphytic Orchid
	<i>Bulbophyllum sikimensis</i> (Lindl.) Rchb.f.			
17	<i>Bulbophyllum affine</i> Wall. ex Lindl.	Hollong	<i>Dipterocarpus retusus</i> Blume	Epiphytic Orchid
	<i>Agrostophyllum planicaule</i> (Wall. ex Lindl.) Rchb.f.			
18	<i>Bulbophyllum roxburghii</i> (Lindl.) Rchb.f.	Hollong	<i>Dipterocarpus retusus</i> Blume	Epiphytic Orchid
	<i>Bulbophyllum sikimensis</i> (Lindl.) Rchb.f.			
19	<i>Bulbophyllum sikimensis</i> (Lindl.) Rchb.f.	Hollong	<i>Dipterocarpus retusus</i> Blume	Epiphytic Orchid
20	<i>Bulbophyllum careyanum</i> (Hook.) Spreng	Hollong	<i>Dipterocarpus retusus</i> Blume	Epiphytic Orchid

	<i>Dendrobium densiflorum</i> Lindl			
21	<i>Bulbophyllum careyanum</i> (Hook.) Spreng <i>Cymbidium aloifolium</i> (L.) Sw. <i>Cymbidium aloifolium</i> (L.) Sw.	Hollong	<i>Dipterocarpus retusus</i> Blume	Epiphytic Orchid
22	<i>Agrostophyllum plumicaule</i> (Wall. ex Lindl.) Rehb. f. <i>Rhynchosyris retusa</i> (L.) Blume	Hollong	<i>Dipterocarpus retusus</i> Blume	Epiphytic Orchid
23	<i>Bulbophyllum careyanum</i> (Hook.) Spreng	Hingari	<i>Castanopsis indica</i> (Roxb. Ex Lindl.) A.D.C.	Epiphytic Orchid
24	<i>Bulbophyllum careyanum</i> (Hook.) Spreng <i>Rhynchosyris retusa</i> (L.) Blume	Hollong	<i>Dipterocarpus retusus</i> Blume	Epiphytic Orchid
25	<i>Bulbophyllum sikkimensis</i> (Lindl.) Rehb. f. <i>Dendrobium apyllum</i> (Roxb.) C.E.C. Fisch.	Hollong	<i>Dipterocarpus retusus</i> Blume	Epiphytic Orchid
26	<i>Bulbophyllum sikkimensis</i> (Lindl.) Rehb. f.	Dimaia	<i>Ficus hispida</i> L. f.	Epiphytic Orchid
27	<i>Agrostophyllum plumicaule</i> (Wall. ex Lindl.) Rehb. f.	Hollong	<i>Dipterocarpus retusus</i> Blume	Epiphytic Orchid
28	<i>Celaosoma subulatum</i> Blum <i>Aerides odorata</i> Lour	Hollong	<i>Dipterocarpus retusus</i> Blume	Epiphytic Orchid
29	<i>Cymbidium aloifolium</i> (L.) Sw. <i>Rhynchosyris retusa</i> (L.) Blume	Jageru	<i>Miconia denticulata</i> (H.) Muell.-Arg	Epiphytic Orchid
30	<i>Bulbophyllum sikkimensis</i> (Lindl.) Rehb. f.	Cimber (Ghila lota)	<i>Entada purpurea</i> DC	Epiphytic Orchid
31	<i>Cymbidium aloifolium</i> (L.) Sw.	Cimber (Ghila lota)	<i>Entada purpurea</i> DC	Epiphytic Orchid
32	<i>Anoctochilus ravbarghii</i> (Wall.) Lindl			Terrestrial Orchid found in some pockets.
33	<i>Zeuxine nervosa</i> (Wall. ex Lindl.)			Terrestrial Orchid found in some pockets.
34	<i>Acanthophippium sylhetense</i>			Terrestrial Orchid found in some pockets.
35	<i>Calanthe musuca</i> (D. Don) Lindl			Terrestrial Orchid found in some pockets.
36	<i>Calanthe byrgioides</i> Rehb. f.			Terrestrial Orchid found in some pockets.
37	<i>Phaius mihimensis</i> Rehb. f.			Terrestrial Orchid found in some pockets.
38	<i>Phaius tankervillei</i> (Blanco) Blume (1)			Terrestrial Orchid found in some pockets.
39	<i>Tainia latifolia</i> (Lindl.) Rehb. f.			Terrestrial Orchid found in some pockets.
40	<i>Tainia wryana</i> (Hook.) f.			Terrestrial Orchid found in some pockets.

Appendix-III (Borduar Orchid Study Plot)

Sl No	Name of the Orchid species found	Name of the host tree		Remarks
		Local Name	Scientific Name	
1	<i>Bulbophyllum careyanum</i> (Hook.) Spreng	Makri Sal	<i>Schima wallichii</i>	Epiphytic Orchid
	<i>Dendrobium densiflorum</i> Lindl			
	<i>Dendrobium fimbriatum</i> Hook			
	<i>Pinellia pumila</i> (Lindl.)			
2	<i>Vanda teres</i> (Roxb) Lindl	Azar	<i>Lagestromia speciosa</i>	Epiphytic Orchid
	<i>Acampe multiflora</i> (Lindl)			
	<i>Bulbophyllum careyanum</i> (Hook.) Spreng			
	<i>Dendrobium fimbriatum</i> Hook <i>Dendrobium anceps</i> Sw.			
3	<i>Dendrobium moschatum</i> (Bach.-ham.) Sw	Azar	<i>Lagestromia speciosa</i>	Epiphytic Orchid
	<i>Dendrobium fimbriatum</i> Hook			
	<i>Pholidota rebra</i> Lindl.			
	<i>Acampe multiflora</i> (Lindl)			
	<i>Dendrobium anceps</i> Sw.			
	<i>Palatandheria insectifera</i> Rehb. f.			
	<i>Pinellia pumila</i> (Lindl.)			
4	<i>Bulbophyllum careyanum</i> (Hook.) Spreng	Azar	<i>Lagestromia speciosa</i>	Epiphytic Orchid
	<i>Dendrobium moschatum</i> (Bach.-ham.) Sw			
	<i>Dendrobium fimbriatum</i> Hook			
	<i>Dendrobium macraei</i> (Lindl.)			
	<i>Bulbophyllum careyanum</i> (Hook.) Spreng			
	<i>Acampe multiflora</i> (Lindl)			
	<i>Dendrobium anceps</i> Sw. <i>Pholidota imbricata</i> (Roxb) <i>Cymbidium aloifolium</i> (L.) Sw <i>Vanda teres</i> (Roxb) Lindl			
5	<i>Bulbophyllum careyanum</i> (Hook.) Spreng	Bogipoma	<i>Chukrasia Tabularia</i>	Epiphytic Orchid

	<i>Ptilanthera Insectifera</i> Rchb.f. <i>Pinolia pumila</i> (Lindl.) <i>Dendrobium fimbriatum</i> Hook <i>Acampe multiflora</i> (Lindl.) <i>Dendrobium anceps</i> Sw. <i>Acampe praemorsa</i> (Roxb)			
6	<i>Phalaenopsis manni</i> Rchb.f. <i>Dendrobium fimbriatum</i> Hook <i>Cymbidium alopathum</i> (L.) Sw <i>Dendrobium moschatum</i> (Buch.-ham.) sw <i>Acampe multiflora</i> (Lindl.) <i>Dendrobium anceps</i> Sw. <i>Ptilanthera Insectifera</i> Rchb.f. <i>Vanda teres</i> (Roxb) Lindl.	Azar	<i>Lagestromia speciosa</i>	Epiphytic Orchid
7	<i>Acampe multiflora</i> (Lindl.) <i>Bulbophyllum careyanum</i> (Hook) spreng <i>Acampe praemorsa</i> (Roxb)	Azar	<i>Lagestromia speciosa</i>	Epiphytic Orchid
8	<i>Ptilanthera Insectifera</i> Rchb.f. <i>Aerides multiflora</i> Roxb. <i>Bulbophyllum careyanum</i> (Hook) spreng <i>Ptilanthera Insectifera</i> Rchb.f. <i>Cymbidium alopathum</i> (L.) Sw <i>Acampe praemorsa</i> (Roxb) <i>Acampe multiflora</i> (Lindl.) <i>Vanda teres</i> (Roxb) Lindl.	Thutimala	<i>Garuga pinnata</i>	Epiphytic Orchid
9	<i>Cymbidium alopathum</i> (L.) Sw <i>Bulbophyllum careyanum</i> (Hook) spreng <i>Dendrobium anceps</i> Sw. <i>Dendrobium ophyllum</i> (Roxb.) <i>Vanda teres</i> (Roxb) Lindl.	Sal	<i>Shorea robusta</i>	Epiphytic Orchid
10	<i>Ptilanthera Insectifera</i> Rchb.f. <i>Dendrobium fimbriatum</i> Hook <i>Pholidota imbricata</i> (Roxb) <i>Aerides multiflora</i> Roxb. <i>Dendrobium anceps</i> Sw. <i>Dendrobium moschatum</i> (Buch.-ham.) sw <i>Bulbophyllum careyanum</i> (Hook) spreng	Katakahi	<i>Bridelia retusa</i>	Epiphytic Orchid
11	<i>Pinolia pumila</i> (Lindl.) <i>Ptilanthera Insectifera</i> Rchb.f. <i>Bulbophyllum careyanum</i> (Hook) spreng <i>Dendrobium anceps</i> Sw. <i>Pholidota imbricata</i> (Roxb)	Sal	<i>Shorea robusta</i>	Epiphytic Orchid
12	<i>Dendrobium moschatum</i> (Buch.-ham.) sw			
13	<i>Cymbidium alopathum</i> (L.) Sw <i>Pinolia pumila</i> (Lindl.) <i>Bulbophyllum careyanum</i> (Hook) spreng <i>Vanda teres</i> (Roxb) Lindl.	Makri Sal	<i>Schinus wallichii</i>	Epiphytic Orchid
14	<i>Dendrobium moschatum</i> (Buch.-ham.) sw <i>Dendrobium anceps</i> Sw. <i>Bulbophyllum careyanum</i> (Hook) spreng	Sal	<i>Shorea robusta</i>	Epiphytic Orchid
15	<i>Pinolia pumila</i> (Lindl.) <i>Dendrobium anceps</i> Sw. <i>Bulbophyllum careyanum</i> (Hook) spreng	Makri Sal	<i>Schinus wallichii</i>	Epiphytic Orchid
16	<i>Cymbidium alopathum</i> (L.) Sw <i>Pholidota imbricata</i> (Roxb) <i>Dendrobium fimbriatum</i> Hook <i>Vanda teres</i> (Roxb) Lindl.	Katakahi	<i>Bridelia retusa</i>	Epiphytic Orchid
17	<i>Pinolia pumila</i> (Lindl.) <i>Bulbophyllum careyanum</i> (Hook) spreng	Sal	<i>Shorea robusta</i>	Epiphytic Orchid
18	<i>Dendrobium anceps</i> Sw. <i>Dendrobium moschatum</i> (Buch.-ham.) sw <i>Pinolia pumila</i> (Lindl.) <i>Cymbidium alopathum</i> (L.) Sw <i>Pinolia pumila</i> (Lindl.)	Makri Sal	<i>Schinus wallichii</i>	Epiphytic Orchid
19	<i>Dendrobium anceps</i> Sw. <i>Bulbophyllum careyanum</i> (Hook) spreng <i>Dendrobium moschatum</i> (Buch.-ham.) sw	Makri Sal	<i>Schinus wallichii</i>	Epiphytic Orchid
20	<i>Bulbophyllum careyanum</i> (Hook) spreng <i>Dendrobium anceps</i> Sw. <i>Pinolia pumila</i> (Lindl.) <i>Cymbidium alopathum</i> (L.) Sw	Sal	<i>Shorea robusta</i>	Epiphytic Orchid

	<i>Phalaenopsis imbricata</i> (Roxb)			
	<i>Ptilanthera insectifera</i> Rehb. f.			
	<i>Acampe praemorsa</i> (Roxb)			
21	<i>Bulbophyllum careyanum</i> (Hook) Spreng	Sal	<i>Shorea robusta</i>	Epiphytic Orchid
	<i>Cymbidium aloofolium</i> (L.) Sw			
	<i>Pinella pumila</i> (Lindl.)			
22	<i>Bulbophyllum careyanum</i> (Hook) Spreng	Sal	<i>Shorea robusta</i>	Epiphytic Orchid
23	<i>Bulbophyllum careyanum</i> (Hook) Spreng	Sal	<i>Shorea robusta</i>	Epiphytic Orchid
	<i>Bulbophyllum careyanum</i> (Hook) Spreng			
24	<i>Acampe praemorsa</i> (Roxb)	Sal	<i>Shorea robusta</i>	Epiphytic Orchid
	<i>Dendrobium anceps</i> Sw.			
	<i>Pinella pumila</i> (Lindl.)			
25	<i>Dendrobium moschatum</i> (Buch.-Ham.) Sw	Sal	<i>Shorea robusta</i>	Epiphytic Orchid
	<i>Bulbophyllum careyanum</i> (Hook) Spreng			
26	<i>Bulbophyllum careyanum</i> (Hook) Spreng	Sal	<i>Shorea robusta</i>	Epiphytic Orchid
	<i>Pinella pumila</i> (Lindl.)			
27	<i>Bulbophyllum careyanum</i> (Hook) Spreng	Sal	<i>Shorea robusta</i>	Epiphytic Orchid
	<i>Pinella pumila</i> (Lindl.)			
	<i>Dendrobium anceps</i> Sw.			
28	<i>Bulbophyllum careyanum</i> (Hook) Spreng	Sal	<i>Shorea robusta</i>	Epiphytic Orchid
	<i>Pinella pumila</i> (Lindl.)			
	<i>Dendrobium moschatum</i> (Buch.-Ham.) Sw			
29	<i>Bulbophyllum careyanum</i> (Hook) Spreng	Sal	<i>Shorea robusta</i>	Epiphytic Orchid
	<i>Pinella pumila</i> (Lindl.)			
30	<i>Bulbophyllum careyanum</i> (Hook) Spreng	Sal	<i>Shorea robusta</i>	Epiphytic Orchid
	<i>Dendrobium anceps</i> Sw.			
31	<i>Cymbidium aloofolium</i> (L.) Sw	Sal	<i>Shorea robusta</i>	Epiphytic Orchid
	<i>Phalaenopsis imbricata</i> (Roxb)			
	<i>Bulbophyllum careyanum</i> (Hook) Spreng			
	<i>Bulbophyllum careyanum</i> (Hook) Spreng			
32	<i>Aerides multiflora</i> Roxb.	Thattimala	<i>Garuga pinnata</i>	Epiphytic Orchid
	<i>Aerides odorata</i> Loar			
	<i>Pinella pumila</i> (Lindl.)			
	<i>Dendrobium anceps</i> Sw.			
	<i>Dendrobium fimbriatum</i> Hook			
33	<i>Pinella pumila</i> (Lindl.)	Azar	<i>Lagestromia speciosa</i>	Epiphytic Orchid
	<i>Acampe multiflora</i> (Lindl.)			
34	<i>Vanda teres</i> (Roxb) Lindl.	Azar	<i>Lagestromia speciosa</i>	Epiphytic Orchid
	<i>Dendrobium anceps</i> Sw.			
	<i>Acampe praemorsa</i> (Roxb)			
35	<i>Vanda teres</i> (Roxb) Lindl.	Azar	<i>Lagestromia speciosa</i>	Epiphytic Orchid
	<i>Phaielenopsis manni</i> Rehb. f.			
36	<i>Bulbophyllum careyanum</i> (Hook) Spreng	Sal	<i>Shorea robusta</i>	Epiphytic Orchid
	<i>Dendrobium moschatum</i> (Buch.-Ham.) Sw			
	<i>Bulbophyllum careyanum</i> (Hook) Spreng			
37	<i>Dendrobium anceps</i> Sw.	Jamuk	<i>Syzygium cumini</i>	Epiphytic Orchid
	<i>Dendrobium moschatum</i> (Buch.-Ham.) Sw			
	<i>Dendrobium moschatum</i> (Buch.-Ham.) Sw			
38	<i>Phaielenopsis manni</i> Rehb. f.	Sal	<i>Shorea robusta</i>	Epiphytic Orchid
	<i>Phalaenopsis imbricata</i> (Roxb)			
	<i>Dendrobium anceps</i> Sw.			
39	<i>Bulbophyllum careyanum</i> (Hook) Spreng	Makri Sal	<i>Schinus wallichii</i>	Epiphytic Orchid
	<i>Cymbidium aloofolium</i> (L.) Sw			
40	<i>Cymbidium aloofolium</i> (L.) Sw	Makri Sal	<i>Schinus wallichii</i>	Epiphytic Orchid
	<i>Dendrobium anceps</i> Sw.			
41	<i>Aerides odorata</i> Loar	Makri Sal	<i>Schinus wallichii</i>	Epiphytic Orchid
42	<i>Aerides odorata</i> Loar	Paroli	<i>Stereospermum chelonoi</i>	Epiphytic Orchid
	<i>Cymbidium aloofolium</i> (L.) Sw			
43	<i>Bulbophyllum careyanum</i> (Hook) Spreng	Sal	<i>Shorea robusta</i>	Epiphytic Orchid
	<i>Dendrobium moschatum</i> (Buch.-Ham.) Sw			
	<i>Dendrobium anceps</i> Sw.			
44	<i>Dendrobium fimbriatum</i> Hook	Paroli	<i>Stereospermum chelonoi</i>	Epiphytic Orchid
	<i>Dendrobium moschatum</i> (Buch.-Ham.) Sw			
	<i>Bulbophyllum careyanum</i> (Hook) Spreng			
	<i>Dendrobium anceps</i> Sw.			
45	<i>Pinella pumila</i> (Lindl.)	Makri Sal	<i>Schinus wallichii</i>	Epiphytic Orchid
	<i>Acampe multiflora</i> (Lindl.)			
	<i>Cymbidium aloofolium</i> (L.) Sw			
46	<i>Bulbophyllum careyanum</i> (Hook) Spreng	Sal	<i>Shorea robusta</i>	Epiphytic Orchid
	<i>Aerides multiflora</i> Roxb.			
	<i>Bulbophyllum careyanum</i> (Hook) Spreng			
47	<i>Cymbidium aloofolium</i> (L.) Sw	Cham Kothai	<i>Artocarpus chamsa</i>	Epiphytic Orchid
	<i>Vanda teres</i> (Roxb) Lindl.			

48	<i>Pinolia pumila</i> (Lindl.) <i>Bulbophyllum careyanum</i> (Hook) spreng	Poma	Toona ciliata	Epiphytic Orchid
49	<i>Bulbophyllum careyanum</i> (Hook) spreng <i>Dendrobium macchatum</i> (Buch.-ham.) sw <i>Dendrobium anceps</i> Sw.	Sal	Shorea robusta	Epiphytic Orchid
	<i>Acampe multiflora</i> (Lindl.) <i>Dendrobium macchatum</i> (Buch.-ham.) sw <i>Vanda teres</i> (Roxb) Lindl			
50	<i>Bulbophyllum careyanum</i> (Hook) spreng <i>Bulbophyllum careyanum</i> (Hook) spreng	Makri Sal	Schinus wallichii	Epiphytic Orchid
51	<i>Vanda teres</i> (Roxb) Lindl <i>Acampe multiflora</i> (Lindl)	Cham Kothal	Artocarpus chama	Epiphytic Orchid
	<i>Bulbophyllum careyanum</i> (Hook) spreng			
52	<i>Acampe praemorsa</i> (Roxb) <i>Bulbophyllum careyanum</i> (Hook) spreng <i>Vanda teres</i> (Roxb) Lindl	Azar	Lagestromia speciosa	Epiphytic Orchid
54	<i>Bulbophyllum careyanum</i> (Hook) spreng <i>Pinolia pumila</i> (Lindl.) <i>Dendrobium anceps</i> Sw. <i>Dendrobium densiflorum</i> Lindl <i>Dendrobium anceps</i> Sw.	Sal	Shorea robusta	Epiphytic Orchid
	<i>Bulbophyllum careyanum</i> (Hook) spreng			
	<i>Bulbophyllum careyanum</i> (Hook) spreng			
55	<i>Bulbophyllum careyanum</i> (Hook) spreng	Katakishi	Bridelia retusa	Epiphytic Orchid
56	<i>Bulbophyllum careyanum</i> (Hook) spreng <i>Bulbophyllum careyanum</i> (Hook) spreng	Sal	Shorea robusta	Epiphytic Orchid
	<i>Dendrobium anceps</i> Sw. <i>Rhynchostylis retusa</i> (L) Blume			
58	<i>Bulbophyllum careyanum</i> (Hook) spreng <i>Dendrobium anceps</i> Sw.	Iiya	Citrus sinensis	Epiphytic Orchid
	<i>Bulbophyllum careyanum</i> (Hook) spreng			
59	<i>Dendrobium anceps</i> Sw. <i>Acampe multiflora</i> (Lindl) <i>Aerides odorata</i> Lour	Sal	Shorea robusta	Epiphytic Orchid
	<i>Bulbophyllum careyanum</i> (Hook) spreng			
	<i>Dendrobium anceps</i> Sw.			
60	<i>Bulbophyllum careyanum</i> (Hook) spreng <i>Dendrobium anceps</i> Sw.	Sal	Shorea robusta	Epiphytic Orchid
	<i>Acampe multiflora</i> (Lindl)			
61	<i>Bulbophyllum careyanum</i> (Hook) spreng	Sal	Shorea robusta	Epiphytic Orchid
62	<i>Dendrobium fimbriatum</i> Hook <i>Cymbidium aloefolium</i> (L.) Sw	Sal	Shorea robusta	Epiphytic Orchid
	<i>Bulbophyllum careyanum</i> (Hook) spreng			
63	<i>Dendrobium anceps</i> Sw. <i>Pinolia pumila</i> (Lindl.) <i>Bulbophyllum careyanum</i> (Hook) spreng	Sal	Shorea robusta	Epiphytic Orchid
	<i>Dendrobium anceps</i> Sw.			
	<i>Bulbophyllum careyanum</i> (Hook) spreng			
65	<i>Dendrobium anceps</i> Sw. <i>Cymbidium bicolor</i> Lindl <i>Vanda teres</i> (Roxb) Lindl <i>Bulbophyllum careyanum</i> (Hook) spreng <i>Dendrobium anceps</i> Sw.	Makri Sal	Schinus wallichii	Epiphytic Orchid
	<i>Cymbidium bicolor</i> Lindl			
	<i>Bulbophyllum careyanum</i> (Hook) spreng			
	<i>Pholidota imbricata</i> (Roxb)			
67	<i>Dendrobium macchatum</i> (Buch.-ham.) sw <i>Dendrobium anceps</i> Sw. <i>Vanda teres</i> (Roxb) Lindl <i>Aerides odorata</i> Lour	Oxy	Paulownia elongata X paulownia hortensis	Epiphytic Orchid
	<i>Pholidota imbricata</i> (Roxb)			
	<i>Dendrobium anceps</i> Sw.			
68	<i>Pholidota imbricata</i> (Roxb)	Sal	Shorea robusta	Epiphytic Orchid
69	<i>Dendrobium anceps</i> Sw. <i>Pholidota imbricata</i> (Roxb)	Makri Sal	Schinus wallichii	Epiphytic Orchid
	<i>Dendrobium macchatum</i> (Buch.-ham.) sw <i>Bulbophyllum careyanum</i> (Hook) spreng <i>Dendrobium anceps</i> Sw.			
70	<i>Bulbophyllum careyanum</i> (Hook) spreng	Sal	Shorea robusta	Epiphytic Orchid
71	<i>Dendrobium anceps</i> Sw. <i>Bulbophyllum careyanum</i> (Hook) spreng <i>Acampe praemorsa</i> (Roxb)	Sal	Shorea robusta	Epiphytic Orchid
	<i>Bulbophyllum careyanum</i> (Hook) spreng			
72	<i>Acampe praemorsa</i> (Roxb)	Cham Kothal	Artocarpus chama	Epiphytic Orchid
73	<i>Bulbophyllum careyanum</i> (Hook) spreng <i>Cymbidium bicolor</i> Lindl	Azar	Lagestromia speciosa	Epiphytic Orchid
	<i>Dendrobium anceps</i> Sw.			
74	<i>Vanda teres</i> (Roxb) Lindl <i>Acampe multiflora</i> (Lindl) <i>Rhynchostylis retusa</i> (L) Blume <i>Bulbophyllum careyanum</i> (Hook) spreng <i>Dendrobium anceps</i> Sw.	Cham Kothal	Artocarpus chama	Epiphytic Orchid
	<i>Bulbophyllum careyanum</i> (Hook) spreng			
	<i>Cymbidium bicolor</i> Lindl			
	<i>Dendrobium anceps</i> Sw.			
75	<i>Vanda teres</i> (Roxb) Lindl <i>Acampe multiflora</i> (Lindl) <i>Rhynchostylis retusa</i> (L) Blume	Azar	Lagestromia speciosa	Epiphytic Orchid
	<i>Bulbophyllum careyanum</i> (Hook) spreng			
76	<i>Dendrobium anceps</i> Sw. <i>Dendrobium anceps</i> Sw.	Cham Kothal	Artocarpus chama	Epiphytic Orchid
	<i>Dendrobium anceps</i> Sw.			
77	<i>Dendrobium anceps</i> Sw.	Azar	Lagestromia speciosa	Epiphytic Orchid

	<i>Vanda teres</i> (Roxb) Lindl			
78	<i>Phalaenopsis manoni</i> Rchb.f	Azar	<i>Lagestromia speciosa</i>	Epiphytic Orchid
	<i>Vanda teres</i> (Roxb) Lindl			
	<i>Bulbophyllum caryanum</i> (Hook) Spreng			
	<i>Dendrobium moschatum</i> (Bach.-ham.) Sw			
79	<i>Phalaenopsis imbricata</i> (Roxb)	Azar	<i>Lagestromia speciosa</i>	Epiphytic Orchid
	<i>Dendrobium moschatum</i> (Bach.-ham.) Sw			

Appendix- IV (Garbhanga Orchid Study Plot)

Sl No	Name of Orchid species found	Host tree name		Remarks
		Local Name	Scientific Name	
1	<i>Cymbidium aloofolium</i> (L.) Sw.	Teak	<i>Tectona grandis</i>	Epiphytic Orchid
	<i>Vanda teres</i> Roxb.			
	<i>Aerides odorata</i> Lour.			
2	<i>Vanda teres</i> Roxb.	Teak	<i>Tectona grandis</i>	Epiphytic Orchid
3	<i>Aerides odorata</i> Lour.	Teak	<i>Tectona grandis</i>	Epiphytic Orchid
4	<i>Vanda teres</i> Roxb.	Teak	<i>Tectona grandis</i>	Epiphytic Orchid
5	<i>Aerides odorata</i> Lour.	Teak	<i>Tectona grandis</i>	Epiphytic Orchid
6	<i>Dendrobium aphyllum</i> Roxb.	Teak	<i>Tectona grandis</i>	Epiphytic Orchid
	<i>Aerides odorata</i> Lour.			
7	<i>Vanda teres</i> Roxb.	Teak	<i>Tectona grandis</i>	Epiphytic Orchid
	<i>Aerides odorata</i> Lour.			
8	<i>Vanda teres</i> Roxb.	Teak	<i>Tectona grandis</i>	Epiphytic Orchid
	<i>Aerides odorata</i> Lour.			
	<i>Aerides multiflora</i> Roxb.			
9	<i>Vanda teres</i> Roxb.	Teak	<i>Tectona grandis</i>	Epiphytic Orchid
	<i>Aerides odorata</i> Lour.			
	<i>Aerides multiflora</i> Roxb.			
10	<i>Vanda teres</i> Roxb.	Teak	<i>Tectona grandis</i>	Epiphytic Orchid
11	<i>Vanda teres</i> Roxb.	Teak	<i>Tectona grandis</i>	Epiphytic Orchid
12	<i>Aerides odorata</i> Lour.	Teak	<i>Tectona grandis</i>	Epiphytic Orchid
13	<i>Vanda teres</i> Roxb.	Teak	<i>Tectona grandis</i>	Epiphytic Orchid
	<i>Aerides odorata</i> Lour.			
	<i>Aerides multiflora</i> Roxb.			
14	<i>Aerides odorata</i> Lour.	Teak	<i>Tectona grandis</i>	Epiphytic Orchid
	<i>Dendrobium aphyllum</i> Roxb.			
15	<i>Vanda teres</i> Roxb.	Teak	<i>Tectona grandis</i>	Epiphytic Orchid
	<i>Aerides odorata</i> Lour.			
16	<i>Cymbidium aloofolium</i> (L.) Sw.	Teak	<i>Tectona grandis</i>	Epiphytic Orchid
	<i>Vanda teres</i> Roxb.			
17	<i>Aerides odorata</i> Lour.	Teak	<i>Tectona grandis</i>	Epiphytic Orchid
	<i>Vanda teres</i> Roxb.			
18	<i>Aerides odorata</i> Lour.	Teak	<i>Tectona grandis</i>	Epiphytic Orchid
	<i>Cymbidium aloofolium</i> (L.) Sw.			
19	<i>Aerides odorata</i> Lour.	Sal	<i>Shorea robusta</i>	Epiphytic Orchid
20	<i>Aerides odorata</i> Lour.	Teak	<i>Tectona grandis</i>	Epiphytic Orchid
21	<i>Dendrobium aphyllum</i> Roxb.	Teak	<i>Tectona grandis</i>	Epiphytic Orchid
22	<i>Cymbidium aloofolium</i> (L.) Sw.	Sal	<i>Shorea robusta</i>	Epiphytic Orchid
	<i>Cymbidium aloofolium</i> (L.) Sw.			
23	<i>Bulbophyllum caryanum</i> (Hook) Spreng	Makri Sal	<i>Schinus wallichii</i>	Epiphytic Orchid
24	<i>Bulbophyllum caryanum</i> (Hook) Spreng	Makri Sal	<i>Schinus wallichii</i>	Epiphytic Orchid
25	<i>Cymbidium aloofolium</i> (L.) Sw.	Sal	<i>Shorea robusta</i>	Epiphytic Orchid
26	<i>Cymbidium aloofolium</i> (L.) Sw.	Makri Sal	<i>Schinus wallichii</i>	Epiphytic Orchid
27	<i>Cymbidium aloofolium</i> (L.) Sw.	Sal	<i>Shorea robusta</i>	Epiphytic Orchid
28	<i>Cymbidium aloofolium</i> (L.) Sw.	Sal	<i>Shorea robusta</i>	Epiphytic Orchid
29	<i>Cymbidium aloofolium</i> (L.) Sw.	Sal	<i>Shorea robusta</i>	Epiphytic Orchid
30	<i>Cymbidium aloofolium</i> (L.) Sw.	Makri Sal	<i>Schinus wallichii</i>	Epiphytic Orchid
31	<i>Cymbidium aloofolium</i> (L.) Sw.	Sal	<i>Shorea robusta</i>	Epiphytic Orchid
32	<i>Cymbidium aloofolium</i> (L.) Sw.	Sal	<i>Shorea robusta</i>	Epiphytic Orchid
33	<i>Bulbophyllum caryanum</i> (Hook) Spreng	Sal	<i>Shorea robusta</i>	Epiphytic Orchid
	<i>Aerides odorata</i> Lour.			
34	<i>Cymbidium aloofolium</i> (L.) Sw.	Teak	<i>Tectona grandis</i>	Epiphytic Orchid
	<i>Aerides odorata</i> Lour.			
35	<i>Cymbidium aloofolium</i> (L.) Sw.	Teak	<i>Tectona grandis</i>	Epiphytic Orchid
36	<i>Cymbidium aloofolium</i> (L.) Sw.	Teak	<i>Tectona grandis</i>	Epiphytic Orchid
37	<i>Vanda teres</i> Roxb.	Teak	<i>Tectona grandis</i>	Epiphytic Orchid
38	<i>Acampe multiflora</i> (Lindl.) Lindl.	Teak	<i>Tectona grandis</i>	Epiphytic Orchid
	<i>Rhyncostylis retusa</i> (L.) Bl.			
39	<i>Vanda teres</i> Roxb.	Teak	<i>Tectona grandis</i>	Epiphytic Orchid
	<i>Rhyncostylis retusa</i> (L.) Bl.			

40	<i>Acampe multiflora</i> (Lindl.) Lindl. <i>Vanda teres</i> Roxb.	Teak	<i>Tectona grandis</i>	Epiphytic Orchid
41	<i>Vanda teres</i> Roxb. <i>Aerides odorata</i> Lour.	Teak	<i>Tectona grandis</i>	Epiphytic Orchid
42	<i>Vanda teres</i> Roxb. <i>Aerides odorata</i> Lour.	Teak	<i>Tectona grandis</i>	Epiphytic Orchid
43	<i>Rhyncostyles retusa</i> (L.) Bl. <i>Aerides odorata</i> Lour.	Teak	<i>Tectona grandis</i>	Epiphytic Orchid
44	<i>Aerides odorata</i> Lour.	Teak	<i>Tectona grandis</i>	Epiphytic Orchid
45	<i>Vanda teres</i> Roxb. <i>Aerides odorata</i> Lour.	Teak	<i>Tectona grandis</i>	Epiphytic Orchid
46	<i>Aerides odorata</i> Lour.	Teak	<i>Tectona grandis</i>	Epiphytic Orchid
47	<i>Cymbidium aloifolium</i> (L.) Sw.	Sal	<i>Shorea robusta</i>	Epiphytic Orchid
48	<i>Vanda teres</i> Roxb. <i>Aerides odorata</i> Lour.	Teak	<i>Tectona grandis</i>	Epiphytic Orchid
49	<i>Cymbidium aloifolium</i> (L.) Sw. <i>Cymbidium aloifolium</i> (L.) Sw.	Teak	<i>Tectona grandis</i>	Epiphytic Orchid
50	<i>Vanda teres</i> Roxb. <i>Aerides odorata</i> Lour.	Teak	<i>Tectona grandis</i>	Epiphytic Orchid
51	<i>Cymbidium aloifolium</i> (L.) Sw. <i>Aerides odorata</i> Lour.	Sal	<i>Shorea robusta</i>	Epiphytic Orchid
52	<i>Aerides odorata</i> Lour.	Teak	<i>Tectona grandis</i>	Epiphytic Orchid
53	<i>Aerides odorata</i> Lour.	Teak	<i>Tectona grandis</i>	Epiphytic Orchid
54	<i>Aerides odorata</i> Lour.	Teak	<i>Tectona grandis</i>	Epiphytic Orchid
55	<i>Cymbidium aloifolium</i> (L.) Sw.	Sal	<i>Shorea robusta</i>	Epiphytic Orchid
56	<i>Cymbidium aloifolium</i> (L.) Sw. <i>Aerides odorata</i> Lour.	Teak	<i>Tectona grandis</i>	Epiphytic Orchid
57	<i>Cymbidium aloifolium</i> (L.) Sw.	Teak	<i>Tectona grandis</i>	Epiphytic Orchid
58	<i>Aerides odorata</i> Lour.	Teak	<i>Tectona grandis</i>	Epiphytic Orchid
59	<i>Bulbophyllum careyanum</i> (Hook) Spreng	Raji Du	<i>Dillenia scabra</i>	Epiphytic Orchid

Appendix-V (Kholabat Orchid Study Plot)

Sl No	Name of Orchid species found	Name of the host tree		Remarks
		Local Name	Scientific Name	
1	<i>Cymbidium aloifolium</i> (L.) Sw.	Ajhar	<i>Lagerstroemia speciosa</i>	Epiphytic Orchid
	<i>Acampe multiflora</i> (Lindl.) Lindl			
	<i>Papilionanthe teres</i> (Roxb.) Schltr.			
2	<i>Cymbidium aloifolium</i> (L.) Sw.	Ajhar	<i>Lagerstroemia speciosa</i>	Epiphytic Orchid
	<i>Acampe multiflora</i> (Lindl.) Lindl			
	<i>Papilionanthe teres</i> (Roxb.) Schltr.			
3	<i>Acampe multiflora</i> (Lindl.) Lindl	Parsli	<i>Stereospermum chelonoides</i>	Epiphytic Orchid
	<i>Acampe praemorsa</i> (Roxb)			
	<i>Cymbidium aloifolium</i> (L.) Sw.			
4	<i>Acampe praemorsa</i> (Roxb)	Kuhir	<i>Bridelia retusa</i>	Epiphytic Orchid
5	<i>Cymbidium aloifolium</i> (L.) Sw.	Gomari	<i>Gmelina arborea</i>	Epiphytic Orchid
6	<i>Cymbidium aloifolium</i> (L.) Sw.	Bhelu	<i>Trewia nudiflora</i>	Epiphytic Orchid
	<i>Bulbophyllum careyanum</i> (Hook) spreng			
7	<i>Acampe praemorsa</i> (Roxb)	Gomari	<i>Gmelina arborea</i>	Epiphytic Orchid
	<i>Cymbidium aloifolium</i> (L.) Sw.			
	<i>Papilionanthe teres</i> (Roxb.) Schltr.			
8	<i>Acampe praemorsa</i> (Roxb)	Ajhar	<i>Lagerstroemia speciosa</i>	Epiphytic Orchid
	<i>Bulbophyllum careyanum</i> (Hook) spreng			
9	<i>Cymbidium aloifolium</i> (L.) Sw.	Sal	<i>Shorea robusta</i>	Epiphytic Orchid
	<i>Bulbophyllum careyanum</i> (Hook) spreng			
10	<i>Acampe multiflora</i> (Lindl.) Lindl	Jamuk	<i>Sygium cumini</i>	Epiphytic Orchid
11	<i>Cymbidium aloifolium</i> (L.) Sw.	Bhelu	<i>Trewia nudiflora</i>	Epiphytic Orchid
	<i>Papilionanthe teres</i> (Roxb.) Schltr.			
	<i>Acampe multiflora</i> (Lindl.) Lindl			
12	<i>Papilionanthe teres</i> (Roxb.) Schltr.	Sal	<i>Shorea robusta</i>	Epiphytic Orchid
13	<i>Cymbidium aloifolium</i> (L.) Sw.	Sal	<i>Shorea robusta</i>	Epiphytic Orchid
14	<i>Cymbidium aloifolium</i> (L.) Sw.	Ajhar	<i>Lagerstroemia speciosa</i>	Epiphytic Orchid
	<i>Acampe praemorsa</i> (Roxb)			
15	<i>Acampe multiflora</i> (Lindl.) Lindl	Barun	<i>Crataeva magna</i>	Epiphytic Orchid
	<i>Bulbophyllum careyanum</i> (Hook) spreng			
	<i>Papilionanthe teres</i> (Roxb.) Schltr.			
16	<i>Bulbophyllum careyanum</i> (Hook) spreng	Ajhar	<i>Lagerstroemia speciosa</i>	Epiphytic Orchid
17	<i>Bulbophyllum careyanum</i> (Hook) spreng	Sal	<i>Shorea robusta</i>	Epiphytic Orchid
18	<i>Cymbidium aloifolium</i> (L.) Sw.	Bhelu	<i>Trewia nudiflora</i>	Epiphytic Orchid
19	<i>Bulbophyllum careyanum</i> (Hook) spreng	Ajhar	<i>Lagerstroemia speciosa</i>	Epiphytic Orchid
20	<i>Bulbophyllum careyanum</i> (Hook) spreng	Sal	<i>Shorea robusta</i>	Epiphytic Orchid
21	<i>Bulbophyllum careyanum</i> (Hook) spreng	Sal	<i>Shorea robusta</i>	Epiphytic Orchid

22	<i>Bulbophyllum careyanum</i> (Hook) spreng	Jamuk	<i>Syzygium cumini</i>	Epiphytic Orchid
23	<i>Bulbophyllum careyanum</i> (Hook) spreng	Sidha	<i>Lagerstroemia parviflora</i>	Epiphytic Orchid
24	<i>Cymbidium alcifolium</i> (L) Sw.	Oxy	<i>Dillenia pentagyna</i>	Epiphytic Orchid
25	<i>Bulbophyllum careyanum</i> (Hook) spreng	Sal	<i>Shorea robusta</i>	Epiphytic Orchid
	<i>Cymbidium alcifolium</i> (L) Sw.			
26	<i>Cymbidium alcifolium</i> (L) Sw.	Jamuk	<i>Syzygium cumini</i>	Epiphytic Orchid
27	<i>Bulbophyllum careyanum</i> (Hook) spreng	Jamuk	<i>Syzygium cumini</i>	Epiphytic Orchid
28	<i>Acampe praemorsa</i> (Roxb)	Sal	<i>Shorea robusta</i>	Epiphytic Orchid
29	<i>Cymbidium alcifolium</i> (L) Sw.	Jamuk	<i>Syzygium cumini</i>	Epiphytic Orchid
	<i>Bulbophyllum careyanum</i> (Hook) spreng			
30	<i>Cymbidium alcifolium</i> (L) Sw.	Ajhar	<i>Lagerstroemia speciosa</i>	Epiphytic Orchid
	<i>Bulbophyllum careyanum</i> (Hook) spreng	Ajhar	<i>Lagerstroemia speciosa</i>	Epiphytic Orchid
31	<i>Cymbidium alcifolium</i> (L) Sw.	Sal	<i>Shorea robusta</i>	Epiphytic Orchid
	<i>Bulbophyllum careyanum</i> (Hook) spreng			
32	<i>Acampe praemorsa</i> (Roxb)	Paroli	<i>Stereospermum chelonoides</i>	Epiphytic Orchid
33	<i>Cymbidium alcifolium</i> (L) Sw.	Sal	<i>Shorea robusta</i>	Epiphytic Orchid
	<i>Bulbophyllum careyanum</i> (Hook) spreng			
34	<i>Acampe praemorsa</i> (Roxb)	Jamuk	<i>Syzygium cumini</i>	Epiphytic Orchid
35	<i>Acampe praemorsa</i> (Roxb)	Paroli	<i>Stereospermum chelonoides</i>	Epiphytic Orchid
36	<i>Bulbophyllum careyanum</i> (Hook) spreng	Sal	<i>Shorea robusta</i>	Epiphytic Orchid
37	<i>Cymbidium alcifolium</i> (L) Sw.	Sal	<i>Shorea robusta</i>	Epiphytic Orchid
38	<i>Acampe praemorsa</i> (Roxb)	Sal	<i>Shorea robusta</i>	Epiphytic Orchid
39	<i>Cymbidium alcifolium</i> (L) Sw.	Sal	<i>Shorea robusta</i>	Epiphytic Orchid
40	<i>Cymbidium alcifolium</i> (L) Sw.	Jamuk	<i>Syzygium cumini</i>	Epiphytic Orchid
41	<i>Cymbidium alcifolium</i> (L) Sw.	Sal	<i>Shorea robusta</i>	Epiphytic Orchid
	<i>Bulbophyllum careyanum</i> (Hook) spreng			
42	<i>Dendrobium aphyllum</i> (Roxb)	Ajhar	<i>Lagerstroemia speciosa</i>	Epiphytic Orchid
	<i>Phalaenopsis mannii</i> Rehb.f.			
43	<i>Phalaenopsis mannii</i> Rehb.f.	Ajhar	<i>Lagerstroemia speciosa</i>	Epiphytic Orchid
	<i>Acampe praemorsa</i> (Roxb)			
44	<i>Cymbidium alcifolium</i> (L) Sw.	Jamuk	<i>Syzygium cumini</i>	Epiphytic Orchid
45	<i>Cymbidium alcifolium</i> (L) Sw.	Hilliba	<i>Terminalia chebula</i>	Epiphytic Orchid
46	<i>Acampe praemorsa</i> (Roxb)	Ajhar	<i>Lagerstroemia speciosa</i>	Epiphytic Orchid
	<i>Cymbidium alcifolium</i> (L) Sw.			
47	<i>Cymbidium alcifolium</i> (L) Sw.	Ihela	<i>Trewia nudiflora</i>	Epiphytic Orchid
	<i>Bulbophyllum careyanum</i> (Hook) spreng			
48	<i>Cymbidium alcifolium</i> (L) Sw.	Sal	<i>Shorea robusta</i>	Epiphytic Orchid



Tools & Equipments used

- *Garmin Vista hand held GPS used for location and demarcation of plots.*
 - *Nikon 7548 Monarc 7 (8×42") Binoculars used for identification of orchids*
 - *Digital Thermo-hygrometer HTC-1 used for recording local temperature and humidity*
 - *Portable digital multi stem Soil thermometer used for recording soil temperature.*
 - *Nikon Camera 42X Optical Zoom used for capturing the pictures of orchids*
 - *Densimeter for ascertaining the canopy density*
 - *Trowel (Khurpi)*
 - *Spade*
 - *Soil collection bags*
 - *Ladder*
 - *Coconut rope*
 - *Paint brush*
 - *Cutter*
 - *Shovel*
- Used for soil sample collection*
- Used for rehabilitation of wind fallen orchids*
- Used for making stripes in the trees*

Tools used during the study



Trowel



Coconut rope



Cutter



Digging bar



Paint brush



Polythene bag



Spade

Equipments used during the study



Nikon Camera 42X



Nikon 7548 Monarc 7



Garmin Vista hand held GPS



Digital Thermohygrometer HTC-1



Multi stem Soil thermometer

Data Collection Teams



Umjakhini



Jeypore



Borduar



Garbhanga



Kholahat



Data Analysis Team

- Sri Dibakar Deb, AFS, Silviculturist, Assam
- Smt. Preeti Buragohain, AFS, Asst. Conservator of Forests
- Smt. Himamoni Handique, Research Officer
- Sri Pranjal Prakash Das, Fr-1

Biodiversity encountered during field visits



Mimosa pudica



Coffea benghalensis



Chimera junonia (Lefebvre)



Wild Cat caterpillar



Juno hiemalis



Macrotis bisoni



Chrysomelid



Euploea swesteri



Juno hiemalis



Colletes cacaeciae