

ABSTRACT OF PROPOSAL

1. Project No : KFRI /503/06
2. Title : Strengthening ex-situ conservation of Evergreen trees
3. Objectives :
 - I. To collect propagules and strengthen the collection of rare and endemic forest tree species in the plot.
 - II. To outplant the seedlings with suitable planting design based on ecological requirements of the species.
 - III. To prepare name boards, sign board, plot chart etc. for all the species.
4. Date of Commencement : April 2006
5. Scheduled date at completion : March 2011
6. Funding Agency : K.F.R.I.
7. Principal Investigator : K.K.Unni
8. Study area : F.R.C.Velupadam
9. Duration of study : 5 years

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ABSTRACT

A total of 181 species have been raised in the conservatory plot. Among these, the species such as *Actinodaphne malabarica*, *Aglaiia barberi*, *Aglaiia malabarica*, *Atuna travancorica*, *Beilshmedia wightii*, *Canarium strictum*, *Chrysophyllum roxbourghii*, *Cynometra beddomei*, *Diospyros paniculata*, *Dipterocarpus bourdillonii*, *Dipterocarpus indicus*, *Humboldtia bourdillonii*, *Hydnocarpus macrocarpa*, *Hydnocarpus pentandra*, *Kingiodendron pinnatum*, *Mesua thwaitesii*, *Otonophelium stipulaceum*, *Poeciloneuron indicum*, *Pterospermum rubiginosum*, *Syzygium stocksii*, *Syzygium travancoricum*, *Vepris bilocularis* etc. are rare endemic and threatened trees of Western Ghats. Altogether 1000 plants representing 45 families and 132 genera have been raised in conservatory plot.

The growth of some selected species planted were monitored at 6 months intervals for the sapling stage and yearly intervals for the tree stage. The general performance of seedlings raised in the conservation plot showed some major difference in the growth rate. Some of the species like *Aglaiia malabarica*, *Alangium salvifolium*, *Ancistrocladus heyneanus*, *Archidendron monadelphum*, *Atuna travancorica*, *Chukrasia tabularis*, *Cleidion javanicum*, *Cynometra beddomei*, *Garcinia spicata*, *Goniothalamus wynaadensis*, *Gymnacranthera canarica*, *Humboldtia brunonis*, *Meiogyne pannosa*, *Otonophelium stipulaceum*, *Syzygium palghatense*, *Vateria macrocarpa* are very poor in growth and species like *Acrocarpus fraxinifolius*, *Aphanamixis polystachya*, *Dimocarpus longan*, *Carallia brachiata*, *Croton malabaricus*, *Chrysophyllum cainito*, *Cleisanthus collinus*, *Dimocarpus longan*, *Dipterocarpus bourdillonii*, *Euodia lunu-ankenda*, *Grewia tiliifolia*, *Harpullia arborea*, *Holoptelia integrifolia*, *Hopea parviflora*, *Hydnocarpus macrocarpa*, *Hydnocarpus*

pentandra, *Kingiodendron pinnatum*, *Poeciloneuron indicum*, *Pterospermum reticulatum*, *Pterospermum rubiginosum*, *Semecarpus kathalekanensis*, *Swietenia macrophylla*, *Syzygium chavaran*, *Xylia xylocarpa* showed better growth rate. The ex-situ conservation of various species is maintained at FRC, Velupadam for addition of species and also as a source of maintained data for various studies.

1.INTRODUCTION

The forest area in Kerala is diminishing rapidly due to various reasons and as a result many of the forest trees are becoming endangered or coming to the verge of extinction. *Atuna indica*, *Atuna travancorica*, *Dipterocarpus bourdillonii*, *Humboldtia bourdillonii*, *Humboldtia decurrens*, *Vateria macrocarpa*, *Cynometra beddomei*, *Cynometra travancorica*, etc. are already in the list of Rare and Endangered category of IUCN. Natural regeneration of many of these species are very low. Some of the commercially important tree species being exploited due to increased demand. According to IUCN(2008) 8.86 percentage of angiosperms of India are facing extinction. It is under this context ex-situ conservation of rare and endangered species attains greater importance.

2.SITE CHARACTERISTICS

2.1. Location

The Kerala Forest Research Institute(KFRI) has a Field Research Centre (FRC) established in 1993 at Velupadam in the Palappilly Range of Chalakkudy Forest Division. It is 25km away from Thrissur, at the midpoint of Amballur-Chimony Dam road and lies at 10° 22' East longitude and 76° 37' North latitude.

2.2. Campus Area-Fig 1.

The Centre was established in 1993 within the reserve Forest area leased from the Kerala Forest Department for the purpose. It was meant mainly to establish experimental plots, conduct plantation trials and live collections.

The total area of FRC is 47.43 ha and there is an office cum laboratory with basic facilities for research work. Close to office building, there is a permanent pond which is utilized for the purpose of irrigation . This area is more or less flat with topography along the side of Amballur- Chimmony Road

for about 50 m. inside and beyond that, it rised to the top of the hillock with an altitude of about 40 m. above msl.

The centre, being a clear-felled teak plantation area, there is a profuse coppicing of *Tectona grandis* along with several other moist deciduous species. The dominant natural growth in the campus are *Albizia odoratissima*, *Alstonia scholaris*, *Bridelia retusa*, *Cassia fistula*, *Dalbergia latifolia*, *Grewia tiliifolia*, *Macaranga peltata*, *Pterocarpus marsupium*, *Schleichera oleosa*, *Terminalia paniculata*, etc.

A Bambusteam comprising over 70 species has been established in an area about 6 ha. in the campus. A nursery of rattans, bamboo and selected forest tree species is also maintained in the campus.

2.3 Climate

The average annual rainfall during the period of 2006-2010 was 3384 mm. and the maximum rainfall of 1274 mm. was recorded in the month of July 2007. The highest rainfall of 180 mm. was recorded on 18th July 2009. A maximum temperature of 38° C was recorded in August 2010 and a minimum of 16° C was recorded in June 2009 during the period of 2008 -2011.

3.METHODOLOGY

3.1.Collection of propagules and Raising of Seedlings

Field trips were conducted to different forest types and areas of Kerala for collecting the planting materials.

Exchange of seeds and seedlings from authentic sources was arranged for certain species . Quite a few species were also collected from local sources.

The seeds collected were sown in the nursery beds, covered with shade nets to provide subdued lighting. The germinated ones were polybagged and maintained in the nursery.

The wildings and seedlings collected were planted in filled polybags and kept under the shade net. Regular watering was provided for the seedlings. Seedlings to be planted in the plot were selected from the nursery and kept in open for hardening.

3.2. Site preparation

An Arboretum of rare and endemic species of southern Western Ghats already been established in the campus of FRC, Velupadam of Palappilly Range. This covers an area of 2.5 ha and contains most evergreen and semi-evergreen species. The natural strands of rare and endemics have been retained as such in the plot. The espacement between the species have been maintained as 5 m.

Further “ The Ex-situ conservation of Evergreen Trees ” were carried out through filling the suitable gaps within the plot by seedlings of evergreen species. An attempt has been made to introduce 5 seedlings of each of same species. However in some cases ,only 1 or 2 seedlings could be planted due to unavailability of such species.

3.3 Outplanting of Seedlings-Fig.2

The gap in the conservation plot were identified and the suitable seedlings to be outplanted were sorted out based on the growth form so as to adjust with the spacing of plants already existing in the plot. The planting started right from the year 2006 during the onset of monsoon. This was further extended to the available area during the subsequent years upto March 2011 with new additions which are totally absent in the plot. Casualty replacement were also carried out in the entire plot.

Live collection of 181 species have been planted of which a good number of species are rare endemics of Western Ghats. At present, apart from the natural strand, more than 1000 individual plants of 6 months to 13 years of growth are being maintained in good condition. Silvicultural operations like regular weeding, removal of climbers, and other undergrowth and chopping of unwanted side branches etc. are being carried out as and when required. Individual plants are being protected by providing fencing with bamboo woven treecovers, shade nets etc.

Plants were watered regularly at an interval of 2 days in a week during summer. Average growth of some early planted trees were recorded at one year intervals and that of seedlings and saplings of recently planted species were recorded at 6 months intervals.

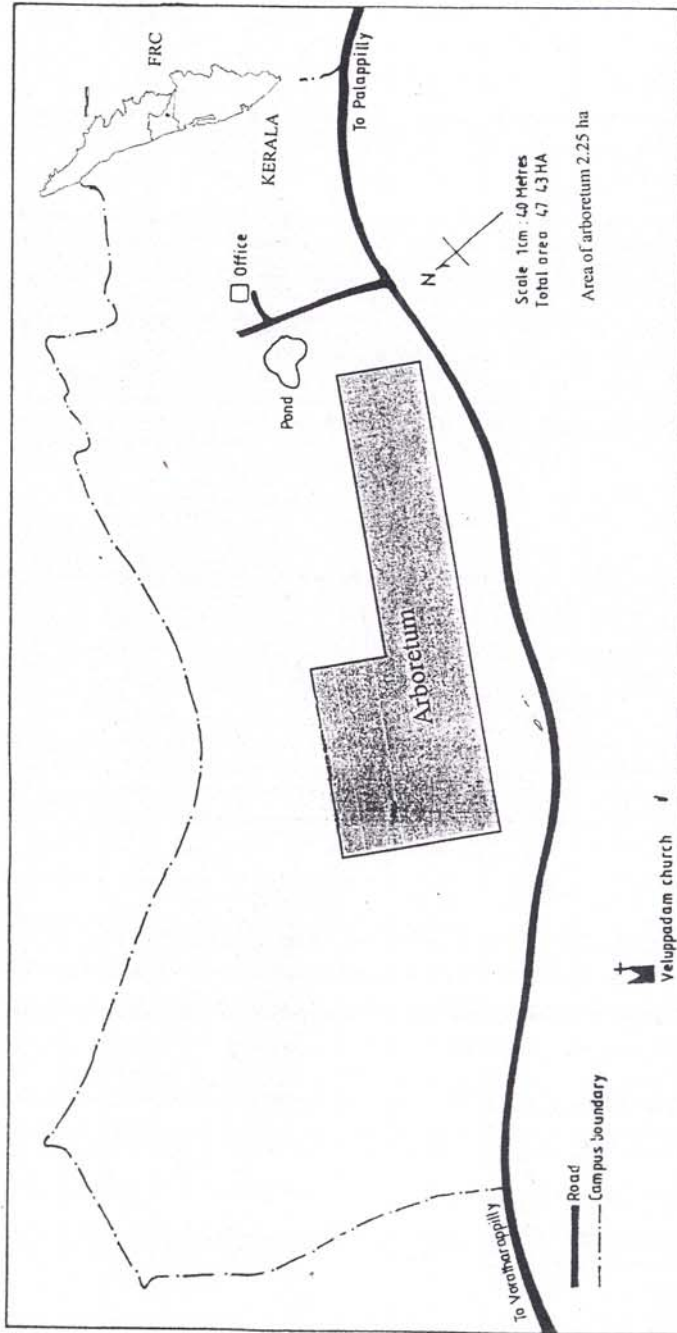


Fig. 1. KFRRI Field Research Centre Palappilly

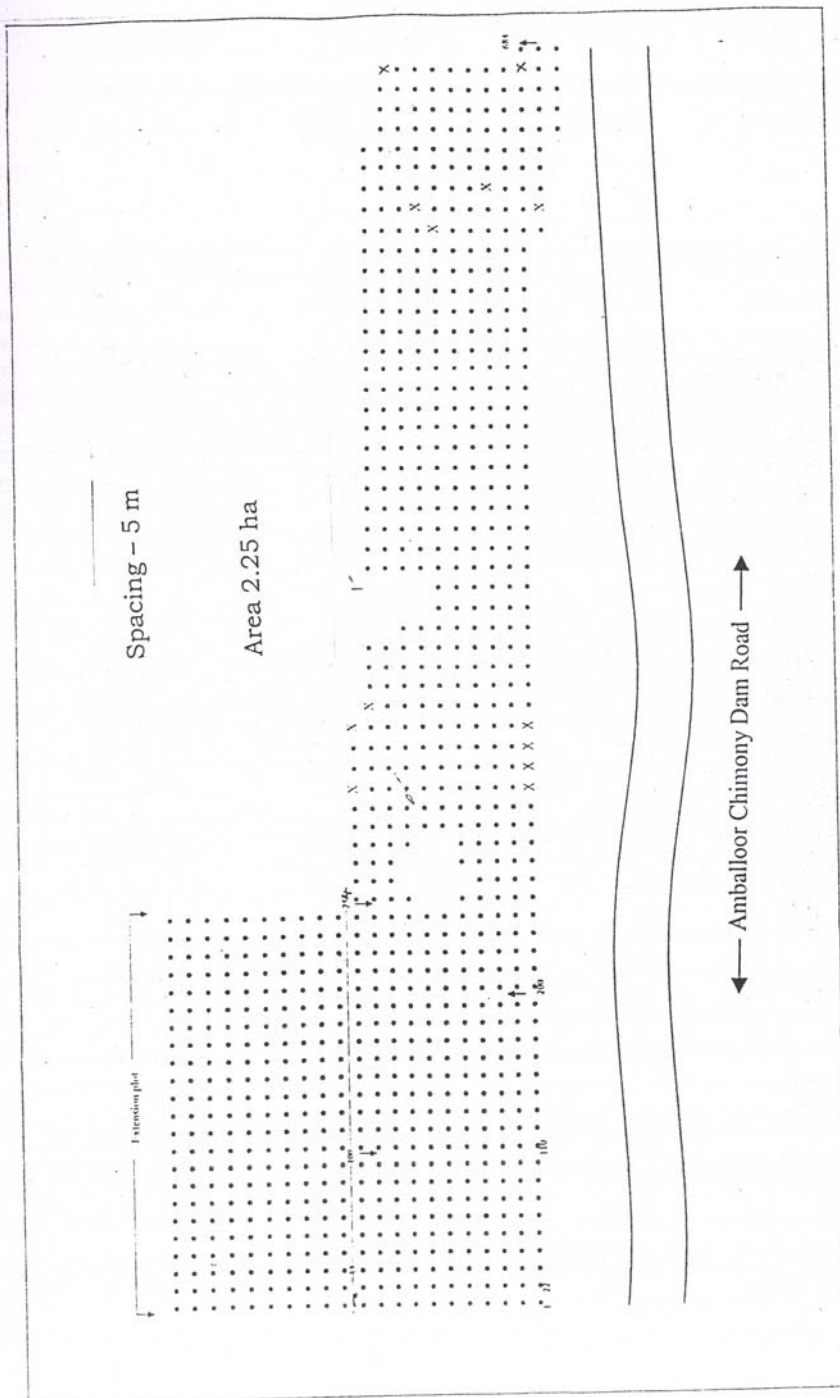


Fig.2 Plot chart of the arboretum at Field Research Centre, Palappilly

RESULTS

A total of 181 species representing 45 families and 132 genera were planted in the Arboretum. These are listed in Table 1 with details on their habit, habitat, location of collection and date of planting. Altogether 1000 plants including seedlings of few unidentified taxa are presently maintained in the Arboretum. Some of the rare endemic species in the Arboretum are *Actinodaphne malabarica*, *Aglaia barberi*, *Aglaia lawii*, *Aglaia malabarica*, *Atuna travancorica*, *Beilschmiedia wightii*, *Blepharistemma serratum*, *Chionanthus mala-elengi*, *Cinnamomum malabattrum*, *Croton malabaricus*, *Cryptocarya beddomei*, *Cynometra beddomei*, *Dipterocarpus bourdillonii*, *Dipterocarpus indicus*, *Derris brevipes*, *Dryptes malabarica*, *Ehretia canarensis*, *Gluta travancorica*, *Hopea parviflora*, *Holigarna arnottiana*, *Hopea ponga*, *Humboldtia brunonis*, *Humboldtia bourdillonii*, *Hydnocarpus macrocarpa*, *Kingiodendron pinnatum*, *Knema attenuata*, *Kunstleria keralensis*, *Lagerstroemia microcarpa*, *Madhuca bourdillonii*, *Memecylon randerianum*, *Neolitsea scrobiculata*, *Ormosia travancorica*, *Otonophelium stipulaceum*, *Palaquium ellipticum*, *Poeciloneuron indicum*, *Pterospermum reticulatum*, *Pterospermum rubiginosum*, *Radermachera xylocarpa*, *Salacia beddomei*, *Spatholobus purpureus*, *Strophanthus wightianus*, *Syzygium chavaran*, *Syzygium mundagam*, *Syzygium munronii*, *Syzygium palghatense*, *Syzygium stocksii*, *Syzygium occidentalis*, *Syzygium travancoricum*, *Vateria indica*, *Vateria macrocarpa*, *Vepris bilocularis*, etc.

Proper identification has been fixed for almost all the plants raised in the plot. Labelling for all outplanted species with botanical name, local name if any and family name were completed for all the species. The name boards were prepared in 12x28 cm. size metallic board with 3 feet long iron rod and fixed on ground under each plant.

Table 1.Species Raised in Arboretum

Sl no:	Plants name	Family	Habit	Habitat	Collection Locality	Date of Planting
1	<i>Acrocarpus fraxinifolius</i> Wight & Arn.	Caesalpiniaceae	Large tree	Evergreen forest	Nilambur	2000
2	<i>Actinodaphne malabarica</i> Balak.	Lauraceae	Large tree	Evergreen forest	Chimmony	1999
3	<i>Adenanthera pavonina</i> L.	Mimosaceae	Medium tree	Introduced	FRC	1998,1999, 2000
4	<i>Aegle marmelos</i> (L.) Corr.	Rutaceae	Small tree	Deciduous forest	FRC	1998
6	<i>Aglaia barberi</i> Gamble	Meliaceae	Small - Medium tree	Evergreen forest	Chimmony	2000
5	<i>Aglaia elaeagnoidea</i> (Juss.) Benth.	Meliaceae	Medium tree	Evergreen forest	Chimmony	2004
7	<i>Aglaia lawii</i> (Wight) Sald.	Meliaceae	Medium tree	Evergreen,Decidu ous forest	Chimmony	2000
8	<i>Aglaia malabarica</i> Sasidh.	Meliaceae	Medium- Large tree	Evergreen forest	Wayanad	2008
9	<i>Alangium salvifolium</i> (L.f.) Wang	Alangiaceae	Small tree	Deciduous forest	Chimmony	2004
10	<i>Albizia odoratissima</i> (L.f.) Benth.	Mimosaceae	Large tree	Dry deciduous forest	FRC	1998
11	<i>Allophylus cobbe</i> (L.) Raeusch.	Sapindaceae	Shrub	Deciduous, Semi - Evergreen forest	Peechi	2000
13	<i>Ancistrocladus heyneanus</i> Wall. ex Graham	Ancistrocladaceae	Woody- Climber	Evergreen forest	Wayanad	2009
12	<i>Antiaris toxicaria</i> (Pers.) Lesch	Moraceae	Large tree	Evergreen, Semi - Evergreen forest	Nilambur	1999
14	<i>Aphanamixis polystachya</i> (Wall.) Parker	Meliaceae	Medium tree	Evergreen, Semi - Evergreen forest	Chimmony	2000,2006

15	<i>Aporosa lindleyana</i> (Wight) Baill.	Euphorbiaceae	Medium tree	Evergreen, Semi - Evergreen forest	Chimmony	1999,2000
18	<i>Archidendron monadelphum</i> (Roxb.) Nielson	Mimosaceae	Small - Medium tree	Evergreen forest	Chimmony	2000
16	<i>Artabotrys ceylanicus</i> Hooh.f. & Thoms.	Annonaceae	Climber	Evergreen, Semi - Evergreen forest	Chimmony	1998
17	<i>Artocarpus hirsutus</i> Lamk.	Moraceae	Large tree	Deciduous forest	Chimmony	1999
19	<i>Atuna travancorica</i> (Bedd.) Kosterm.	Chrysobalanaceae	Medium tree	Evergreen forest	Peechi	2010
20	<i>Azadirachta indica</i> A.Juss.	Meliaceae	Small - Medium tree	Dry deciduous forest	FRC	1998
24	<i>Bauhinia malabarica</i> Roxb.	Caesalpiniaceae	Small tree	Deciduous forest	FRC	1998
26	<i>Bauhinia racemosa</i> Lamk.	Caesalpiniaceae	Small tree	Dry deciduous forest	Local	
25	<i>Bauhinia phoenicea</i> Wight & Arn.	Caesalpiniaceae	Climber	Evergreen, Semi - Evergreen forest	Wayanad	2008
21	<i>Beaumontia jerdoniana</i> Wight	Apocynaceae	Climber	Evergreen forest	Wayanad	2008
22	<i>Beilschmiedia wightii</i> (Nees) Benth.	Lauraceae	Large tree	Evergreen, Semi - Evergreen forest	Nilambur	2000,2006
23	<i>Blepharistemma serratum</i> (Dennst.) Suresh	Rhizophoraceae	Medium tree	Moist deciduous,Semi - Evergreen forest	Local	1998
27	<i>Briedelia retusa</i> (L.) Spreng	Euphorbiaceae	Large tree	Deciduous, Semi - Evergreen forest	Peechi	1998
28	<i>Calophyllum calaba</i> L.	Clusiaceae	Medium tree	Evergreen, Semi - Evergreen forest	FRC	2008
29	<i>Calophyllum inophyllum</i> L.	Clusiaceae	Medium tree	Mangrove,plain	Peechi	2006
30	<i>Canarium strictum</i> Roxb.	Burseraceae	Small tree	Evergreen, Semi - Evergreen forest	Chimmony	2004

31	<i>Carallia brachiata</i> (Lour.) Merr.	Rhizophoraceae	Large tree	Semievergreen forest	Peechi	1999
32	<i>Careya arborea</i> Roxb.	Lecythidaceae	Small tree	Deciduous forest	Peechi	1998
33	<i>Caryota urens</i> L.	Arecaceae	Large Palm	Evergreen forest	Peechi	2000
34	<i>Casearia ovata</i> (Lamk.) Willd.	Flacourtiaceae	Small tree	Evergreen, Semi - Evergreen ,shola forest	Chimmony	2004
35	<i>Chionanthus mala-elengi</i> (Dennst.)P.S. Green	Oleaceae	Small tree	Deciduous, Evergreen, Semi -Evergreen forest	Peechi	1998
37	<i>Chrysophyllum cainito</i> L.	Sapotaceae	Medium tree	Wild	Peechi	1999,2008
36	<i>Chrysophyllum roxburghii</i> G. Don	Sapotaceae	Large tree	Evergreen forest	Nilambur	1999,2008
38	<i>Chukrasia tabularis</i> A.Juss.	Meliaceae	Large tree	Evergreen forest	Nilambur	1999
39	<i>Cinnamomum malabattrum</i> (Burm.f.) Blume	Lauraceae	Medium tree	Evergreen, Semi - Evergreen forest	Peechi	1998
40	<i>Cipadessa baccifera</i> (Roth) Miq.	Meliaceae	Small tree	Deciduous, Semi - Evergreen forest	Peechi	2000
41	<i>Cleidion javanicum</i> Blume	Euphorbiaceae	Medium tree	Semievergreen forest	Nilambur	2001
42	<i>Cleisanthus collinus</i> (Roxb.)Benth.ex Hook.f.	Euphorbiaceae	Small - Medium tree	Deciduous forest	Peechi	1998
43	<i>Croton caudatus</i> Giesel.	Euphorbiaceae	Climber	Evergreen, Semi - Evergreen forest	Peechi	2004
44	<i>Croton malabaricus</i> Bedd.	Euphorbiaceae	Small - Medium tree	Evergreen, Semi - Evergreen forest	Chimmony	1999
45	<i>Croton roxburghii</i> Balakr.	Euphorbiaceae	Medium tree	Deciduous forest	Chimmony	1998
46	<i>Cryptocarya beddomei</i> Gamble	Lauraceae	Medium tree	Evergreen, Shola forest	Chimmony	2004

47	<i>Cyathocalyx zeylanica</i> Champ.ex Hook.f.& Thoms.	Annonaceae	Small - Medium tree	Evergreen, Semi - Evergreen forest	Chimmony	2004
48	<i>Cynometra beddomei</i> Prain	Caesalpiniaceae	Medium tree	Evergreen, Semi - Evergreen forest	Wayanad	2008
49	<i>Dalbergia horrida</i> (Dennst.) Mabb.	Fabaceae	Climber	Deciduous, Semi - Evergreen forest	Natural	
51	<i>Dalbergia lanceolaria</i> L.f.	Fabaceae	Medium tree	Deciduous forest	Natural	
50	<i>Dalbergia latifolia</i> Roxb.	Fabaceae	Large tree	Deciduous forest	Local	2000
52	<i>Dalbergia volubilis</i> Roxb.	Fabaceae	Climber	Moist deciduous forest	Natural	
53	<i>Derris brevipes</i> (Benth.) Baker	Caesalpiniaceae	Climber	Moist deciduous forest	Wayanad	2008
54	<i>Desmos lawii</i> (Hook.f. & Thoms.) Safford	Annonaceae	Climber	Evergreen, Semi - Evergreen	Chimmony	2000
55	<i>Dillenia pentagyna</i> Roxb.	Dilleniaceae	Large tree	Deciduous forest	Peechi	2000
56	<i>Dimocarpus longan</i> Lour.	Sapindaceae	Medium tree	Evergreen, Semi Evergreen forest	Nilambur	1998
59	<i>Diospyros peregrina</i> (Gaertn.)Gurke	Ebenaceae	Small - Medium tree	Evergreen forest	FRC	2006
57	<i>Diospyros ebenum</i> Koenig	Ebenaceae	Medium tree	Dry Deciduous forest	Peechi	2008
58	<i>Diospyros montana</i> Roxb.	Ebenaceae	Small - Medium tree	Moist Deciduous, Semi -Evergreen forest	Natural	
60	<i>Diospyros paniculata</i> Dalz.	Ebenaceae	Medium tree	Ever forest reen, Semi -Evergreen	Nilambur,Chimmony	1998,2007
61	<i>Dipterocarpus bourdillonii</i> Brand.	Diperocarpaceae	Large tree	Evergreen forest	Peechi	2007,2010

62	<i>Dipterocarpus indicus</i> Bedd.	Diperocarpaceae	Large tree	Evergreen, Semi - Evergreen forest	Peechi	2009
65	<i>Dryptes malabarica</i> (Bedd.) Airy Shaw	Euphorbiaceae	Small - Medium tree	Evergreen forest	Chimmony	1998
63	<i>Dryptes elata</i> (Bedd.) Pax. & Hoffm.	Euphorbiaceae	Large tree	Evergreen, Semi - Evergreen forest	Chimmony	1998
64	<i>Dryptes oblongifolia</i> (Bedd.) Airy Shaw	Euphorbiaceae	Small tree	Evergreen forest	Chimmony	1998
66	<i>Dysoxylum malabaricum</i> Bedd.ex Hiern	Meliaceae	Large tree	Evergreen forest	Peechi	2009
69	<i>Ehretia canarensis</i> (Clarke) Gamble	Boraginaceae	Small tree	MoistDeciduous, Semi -Evergreen forest	Chimmony	2004
67	<i>Elaeocarpus serratus</i> L.	Elaeocarpaceae	Large tree	Evergreen forest	Chimmony	1999
68	<i>Eleutenanthera ruderalis</i> (Sw.) Sch.-Bip.	Asteraceae	Small tree	MoistDeciduous forest	Peechi	2000
70	<i>Euodia lunu- ankenda</i> (Gaertn.) Merr.	Rutaceae	Small- Medium tree	Evergreen, Semi - Evergreen forest	Chimmony	1998
71	<i>Ficus religiosa</i> L.	Moraceae	Medium tree	Deciduous forest	FRC	1998
72	<i>Firmiana colorata</i> (Roxb.) R.Br.	Sterculiaceae	Medium tree	Deciduous , Semi - Evergreen forest	Chimmony	2000
73	<i>Flacourtia montana</i> Grah.	Flacourtiaceae	Small - Medium tree	Evergreen, Semi - Evergreen forest	Chimmony	1999
74	<i>Garcinia gummi-gutta</i> (L.) Robs.	Clusiaceae	Medium tree	Evergreen forest	Local	2004
75	<i>Garcinia spicata</i> (Wight & Arn.) Hook.f.	Clusiaceae	Medium tree	Evergreen, Semi - Evergreen forest	Local	2004,2007
77	<i>Glochidion zeylanicum</i> (Gaertn.) A.Juss.	Euphorbiaceae	Small tree	Evergreen Deciduous forest	Nilambur	1998
76	<i>Gluta travancorica</i> Bedd.	Anacardiaceae	Large tree	Evergreen forest	Peechi	2008
78	<i>Gmelina arborea</i> Roxb.	Verbenaceae	Medium tree	Deciduous forest	Local	1999
79	<i>Goniothalamus wynaadensis</i> Bedd.	Annonaceae	Small tree	Evergreen forest	Wayanad	2008

80	<i>Grewia tiliifolia</i> Vahl	Tiliaceae	Medium tree	Deciduous forest	Local	2002
81	<i>Gymnacranthera farquhariana</i> (Hook.f.& Thomas.) Warb.	Myristicaceae	Large tree	Evergreen forest	Peechi	2007
82	<i>Harpullia arborea</i> (Blanco) Radlk.	Sapindaceae	Small tree	Deciduous forest	Sholayar	2000
83	<i>Holigarna arnottiana</i> Hook.f.	Anacardiaceae	Large tree	Evergreen, Semi - Evergreen forest	Peechi	2008
84	<i>Holoptelia integrifolia</i> (Roxb.) Planch.	Ulmaceae	Medium tree	Semi-Evergreen forest	Chimmony	1998
85	<i>Hopea parviflora</i> Bedd.	Diperocarpaceae	Large tree	Evergreen, Semi - Evergreen forest	Chimmony	1999
86	<i>Hopea ponga</i> (Dennst.) Mabber.	Diperocarpaceae	Large tree	Evergreen, Semi - Evergreen forest	Wayanad	2008
87	<i>Hopea racophloea</i> Dyer.	Diperocarpaceae	Large tree	Evergreen forest	Nilambur	2008
88	<i>Humboldtia brunonis</i> Wall.	Caesalpiniaceae	Small tree	Evergreen forest	Wayanad	2008
90	<i>Humboldtia bourdillonii</i> Prain	Caesalpiniaceae	Medium tree	Evergreen forest	Peechi	2008,2010
89	<i>Humboldtia vahliana</i> Wight	Caesalpiniaceae	Small - Medium tree	Evergreen, Semi - Evergreen forest	Peechi	1999
91	<i>Hydnocarpus alpina</i> Wight	Flacourtiaceae	Medium tree	Evergreen, Semi - Evergreen forest	Chimmony	2004
92	<i>Hydnocarpus macrocarpa</i> (Bedd.) Warb.	Flacourtiaceae	Medium tree	Evergreen forest	Wayanad, Peechi	1998,2008
93	<i>Hydnocarpus pentandra</i> (Buch.-Ham.) Oken	Flacourtiaceae	Medium tree	Deciduous, Semi - Evergreen forest	Peechi	1998
94	<i>Ixora brachiata</i> Roxb.ex DC.	Rubiaceae	Small tree	Semi-evergreen forest	Chimmony	1998
95	<i>Kingiodendron pinnatum</i> (Roxb.ex.DC.) Harms	Caesalpiniaceae	Large tree	Evergreen forest	FRC	2006
96	<i>Knema attenuata</i> (Wall.ex Hook.f.& Thoms.) Warb.	Myristicaceae	Medium tree	Evergreen,Semi Evergreen forest	Peechi	2009

97	<i>Kunstleria keralensis</i> Mohanan & Nair	Fabaceae	Climber	Evergreen, Semi - Evergreen forest	Chimmony	2008
98	<i>Lagerstroemia microcarpa</i> Wight	Lythraceae	Large tree	Deciduous forest	Chimmony	2001
99	<i>Lagerstroemia reginae</i> Roxb.	Lythraceae	Medium tree	Deciduous, Semi - Evergreen forest	Nilambur	2000
100	<i>Lannea coromandelica</i> (Houtt.) Merr.	Anacardiaceae	Large tree	Deciduous forest	FRC	2000
101	<i>Lepisanthes senegalensis</i> (Juss.ex. Poir.) Leenh.	Sapindaceae	Small tree	Dry-Deciduous forest	Chimmony	2000,2004
102	<i>Lepisanthes tetraphylla</i> (Vahl) Radlk.	Sapindaceae	Small - Medium tree	Evergreen, Semi - Evergreen forest	Chimmony	1998
103	<i>Litsea coriacea</i> (Heyne ex Wall.) Hook.f.	Lauraceae	Medium tree	Semi-Evergreen forest	Wayanad	2008
104	<i>Litsea oleoides</i> (Meissn.) Hook.f.	Lauraceae	Large tree	Evergreen,Semi Evergreen	Chimmony	1998
105	<i>Lophopetalum wightianum</i> Arn.	Celastraceae	Large tree	Evergreen forest	Peechi	2008
106	<i>Madhuca bourdillonii</i> (Gamble) H.J.Lam	Sapotaceae	Large tree	Semi-Evergreen forest	Peechi	1998
107	<i>Margaritaria indica</i> (Dalz.) Airy Shaw	Euphorbiaceae	Medium tree	Semi-Evergreen forest	Chimmony	1998
108	<i>Mastixia arborea</i> (Wight) Bedd.	Cornaceae	Medium tree	Evergreen,Shola forest	Chimmony	2004
111	<i>Meiogyne pannosa</i> (Dalz.) Sinclair	Annonaceae	Small tree	Evergreen forest	Chimmony	2004
112	<i>Meiogyne ramarowii</i> (Dunn) Gandhi	Annonaceae	Shrub	Evergreen forest	Chimmony	2004
113	<i>Melia dubia</i> Cav.	Meliaceae	Medium tree	Deciduous forest	Local	1998
109	<i>Memecylon deccanense</i> Talb.	Melastomataceae	Shrub	Semi-Evergreen forest	Chimmony	2004
110	<i>Memecylon randerianum</i> SM& MR Almeida	Melastomataceae	Shrub	Evergreen, Semi - Evergreen forest	Wayanad	2008
114	<i>Mesua ferrea</i> L.	Clusiaceae	Large tree	Evergreen forest	FRC	2006

115	<i>Mesua thwaitesii</i> Planch.& Triana	Clusiaceae	Medium tree	Evergreen forest	Sholayar	2004
116	<i>Mimusops elengi</i> L.	Sapotaceae	Large tree	Evergreen, Semi - Evergreen forest	Chimmony	2000
117	<i>Mitragyna parvifolia</i> (Roxb.) Kunth	Rubiaceae	Medium tree	Deciduous forest	Peechi	2000
118	<i>Myristica fatua</i> Houtt.var. <i>magnifica</i> (Bedd.) Sinclair	Myristicaceae	Large tree	Swamp forests	Peechi	2007
119	<i>Neolitsea scrobiculata</i> (Meissn.) Gamble	Lauraceae	Medium tree	Evergreen,Shola forest	Chimmony	2000
120	<i>Nothopegia colebrookeana</i> (Wight) Blume	Anacardiaceae	Medium tree	Evergreen, Semi - Evergreen forest	Nilambur	2000
121	<i>Olea dioica</i> Roxb.	Oleaceae	Small - Medium tree	Evergreen, Semi - Evergreen forest	Chimmony	1999
122	<i>Ormosia travancorica</i> Bedd.	Fabaceae	Large tree	Evergreen,SemiEvergreen forest	Chimmony,Peechi	2000
123	<i>Oroxylum indicum</i> (L.) Vent.	Bignoniaceae	Small - Medium tree	Deciduous forest	FRC	1998
124	<i>Otonophelium stipulaceum</i> (Bedd.) Radlk.	Sapindaceae	Medium tree	Evergreen, Semi - Evergreen forest	Chimmony	2002,2006
126	<i>Pajanelia longifolia</i> (Willd.) K.Schum.	Bignoniaceae	Medium tree	SemiEvergreen,Moist deciduous forest	Peechi	1998
127	<i>Palaquium ellipticum</i> (Dalz.) Engl.	Sapotaceae	Large tree	Evergreen forest	Wayanad	2008
125	<i>Paracroton pendulus</i> (Hassk.)Miq	Euphorbiaceae	Large tree	Deciduous forest	Chimmony	2004,2006
128	<i>Persea macrantha</i> (Nees) Kosterm.	Lauraceae	Large tree	Evergreen, Semi - Evergreen forest	Vazhachal,Peechi	1999
129	<i>Poeciloneuron indicum</i> Bedd.	Clusiaceae	Large tree	Evergreen forest	Wayanad	2008

130	<i>Polyalthia fragrans</i> (Dalz.) Bedd.	Annonaceae	Large tree	Evergreen, Semi - Evergreen forest	Chimmony	1998
131	<i>Psydrax dicoccos</i> Gaertn.	Rubiaceae	Small tree	Evergreen, Semi - Evergreen forest	Peechi	2007
132	<i>Pterocarpus dalbergioides</i> Roxb.	Fabaceae	Large tree	Plantations	Andaman	2000
134	<i>Pterocarpus marsupium</i> Roxb.	Fabaceae	Large tree	Deciduous forest	Natural	
133	<i>Pterocarpus santalinus</i> L.f.	Fabaceae	Large tree	Cultivated	FRC	1998
135	<i>Pterospermum reticulatum</i> Wight & Arn.	Sterculiaceae	Large tree	Evergreen, Moist deciduous, Semi - Evergreen forest	Sholayar, Chimmony	1999,2000
136	<i>Pterospermum rubiginosum</i> Heyne. ex Wight & Arn.	Sterculiaceae	Large tree	Evergreen, Semi - Evergreen forest	Sholayar	1999
137	<i>Pterygota alata</i> (Roxb.) R.Br.	Sterculiaceae	Large tree	Evergreen, Semi - Evergreen forest	Nilambur	2007
141	<i>Quassia indica</i> (Gaertn.) Nooteb.	Simaroubaceae	Small tree	Moist deciduous forest	Chimmony	1998
138	<i>Radermachera xylocarpa</i> (Roxb.) K.Schum.	Bignoniaceae	Medium- Large tree	Deciduous forest	Peechi	2009
139	<i>Sageraea grandiflora</i> Dunn	Annonaceae	Large tree	Evergreen forest	Wayanad	2008
140	<i>Salacia beddomei</i> Gamble	Celastraceae	Climber	Evergreen, Semi - Evergreen forest	Wayanad	2008
142	<i>Sapindus trifoliata</i> L.	Sapindaceae	Small tree	Semi-evergreen forest	Chimmony	2000
143	<i>Sarcostigma kleinii</i> Wight & Arn.	Iccacinaceae	Climber	Evergreen, Semi - Evergreen forest	Chimmony	2000
144	<i>Schleichera oleosa</i> (Lour.) Oken	Sapindaceae	Large tree	Deciduous forest	Nilambur	2001
145	<i>Semecarpus kathalekanensis</i> Dassapa & Swaminath.	Anacardiaceae	Medium tree	Deciduous, Semi - Evergreen forest	Peechi	2007
146	<i>Spathodea companulata</i> Beauv.	Bignoniaceae	Medium tree	Coffee plantations	Peechi	2004

147	<i>Spatholobus purpureus</i> Benth.ex Baker	Fabaceae	Woody-Climber	Evergreen, Semi - Evergreen forest	Wayanad	2008
148	<i>Spondias pinnata</i> (L.f) Kurz	Anacardiaceae	Large tree	Deciduous, Semi - Evergreen forest	Peechi	2000
149	<i>Sterculia guttata</i> Roxb.	Sterculiaceae	Large tree	Semi-evergreen forest	Local	
150	<i>Sterculia urens</i> Roxb.	Sterculiaceae	Large tree	Dry deciduous forest	Vazhachal	1999
151	<i>Stereospermum colais</i> (Buch.-Ham.ex Dillw.)	Bignoniaceae	Medium tree	Deciduous, Semi - Evergreen forest	Peechi	2007
152	<i>Strombosia ceylanica</i> Gardn.	Olacaceae	Medium tree	Evergreen forest	Chimmony	1998
153	<i>Strophanthus wightianus</i> Wall.ex Wight	Apocynaceae	Climber	Sea coast	Wayanad	2008
154	<i>Swietenia macrophylla</i> King	Meliaceae	Large tree	Plantation	Peechi	1998
161	<i>Syzygium occidentale</i> (Bourd.) Gandhi	Myrtaceae	Small tree	Evergreen forest	Peechi	2008
155	<i>Syzygium caryophyllatum</i> (L.) Alston	Myrtaceae	Large tree	Evergreen,Semi - Evergreen forest	Peechi	2000
156	<i>Syzygium chavaran</i> (Bourd.) Gamble	Myrtaceae	Large tree	Evergreen, Semi - Evergreen forest	Nilambur	1998
157	<i>Syzygium cumini</i> (L.) Skeels	Myrtaceae	Medium-Large tree	Evergreen, Semi - Evergreen forest	Peechi,Nelli ampathy	1999
158	<i>Syzygium heyneanum</i> (Duthie) Wall.ex Gamble	Myrtaceae	Small tree	Evergreen forest	Wayanad	2008
159	<i>Syzygium mundagam</i> (Bourd.) Chitra	Myrtaceae	Medium tree	Evergreen forest	Wayanad	2008
160	<i>Syzygium munronii</i> (Wight) Chandr.	Myrtaceae	Small tree	Evergreen forest	Wayanad	2008
162	<i>Syzygium palghatense</i> Gamble	Myrtaceae	Large tree	Evergreen forest	Wayanad	2008
163	<i>Syzygium stocksii</i> (Duthie) Gamble	Myrtaceae	Medium tree	Evergreen forest	Peechi	2008
164	<i>Syzygium travancoricum</i> Gamble	Myrtaceae	Medium tree	Mangrove, Semi - Evergreen forest	Chimmony	2000
166	<i>Terminalia bellirica</i> (Gaertn.) Roxb.	Combretaceae	Large tree	Deciduous forest	Chimmony	2000

167	<i>Terminalia chebula</i> Retz.	Combretaceae	Large tree	Dry&Moist deciduous forest	Nilambur	2000
165	<i>Terminalia cuneata</i> Roth.	Combretaceae	Large tree	Deciduous forest	Chimmony	2000
168	<i>Terminalia elliptica</i> Willd.	Combretaceae	Large tree	Deciduous forest	Nilambur	1999
169	<i>Terminalia paniculata</i> Roth.	Combretaceae	Large tree	Moist deciduous forest	Chimmony	1998
170	<i>Terminalia travancorensis</i> Wight & Arn.	Combretaceae	Large tree	Evergreen forest	Peechi	2009
171	<i>Tetrameles nudiflora</i> R.Br.	Datisceae	Large tree	Evergreen, Semi - Evergreen forest	Natural	1998
172	<i>Trewia nudiflora</i> L.	Euphorbiaceae	Small-Medium tree	Evergreen, Semi - Evergreen forest	Natural	1998
173	<i>Uvaria narum</i> (Dunal)Wall.ex Hook.f. & Thoms.	Annonaceae	Climber	Deciduous forest	Chimmony	2004
174	<i>Vateria indica</i> L.	Dipterocarpaceae	Large tree	Evergreen forest	Peechi	1998
175	<i>Vateria macrocarpa</i> Gupta	Dipterocarpaceae	Large tree	Evergreen forest	Wayanad	2008
176	<i>Vepris bilocularis</i> (Wight & Arn.) Engl.	Rutaceae	Medium-Large tree	Evergreen forest	Chimmony	2000
177	<i>Vitex altissima</i> L.	Verbenaceae	Large tree	Deciduous forest	Nilambur	1998
178	<i>Walsura trifolia</i> (Juss.) Harms	Meliaceae	Small - Medium tree	Dry-deciduous, Semi -Evergreen forest	Wayanad	2000,2006
179	<i>Xylia xylocarpa</i> (Roxb.)Taub.	Mimosaceae	Large tree	Deciduous Forest	Chimmony	1999
180	<i>Xanthophyllum arnottianum</i> Wight	Xanthophyllaceae	Straggler	Moist deciduous forest	Chimmony	2000
181	<i>Zanthoxylum rhetsa</i> (Roxb.) DC.	Rutaceae	Small - Medium tree	Deciduous forest	Peechi	1998

Table2. List of Natural Strands At conservatory Plot At FRC
Palappilly

1. *Albizia odoratissima*(L.f.) Benth.
2. *Alstonia scholaris*(L.) R.Br.
3. *Blepharistemma serratum*(Dennst.) Suresh
4. *Briedelia retusa* (L.) Spreng
5. *Cassia fistula* L.
6. *Cycas circinalis* L.
7. *Dalbergia horrida* (Dennst.) Mabb.
8. *Dalbergia lanceolaria* L.f.
9. *Dalbergia latifolia* Roxb.
10. *Dalbergia volubilis* Roxb.
11. *Dillenia pentagyna* Roxb.
12. *Ficus benghalensis* L.
13. *Ficus hispida* L.f.
14. *Flacourtia montana* Grah.
15. *Grewia tiliifolia* Vahl
16. *Hollarhena pubescens* (Buch.-Ham.) Wall.ex G.Don
17. *Macaranga peltata* (Roxb.) Muell.-Arg
18. *Melia dubia* Cav.
19. *Pterocarpus marsupium* Roxb.
20. *Schleichera oleosa* (Lour.)Oken
21. *Sterculia guttata* Roxb.
22. *Stereospermum colais* (Buch.-Ham.ex Dillw.)
23. *Strychnos nux-vomica* L.
24. *Tabernaemontana heyneana* Wall.
25. *Tectona grandis* L.f.
26. *Trewia nudiflora* L.
27. *Wrightia tinctoria* (Roxb.)R.Br.

The table 3 : Average rate of Growth(Height & Girth in cm)- for selected species

Species Name	Year of Observation					
	Nov 08		Nov 09		Nov 10	
	Height	Girth	Height	Girth	Height	Girth
<i>Canthium dicoccum</i>	248	7.05	223.75	4.6	348	7.27
<i>Chrysophyllum cainito</i>	341.6	9.33	522	17.78	650.33	20.3
<i>Chrysophyllum roxbourghii</i>	582	29.62	799	34.32	921.2	44.2
<i>Cleistanthus collinus</i>	1076.67	74.5	1223.33	83.66	1268	77.26
<i>Dimocarpus longan</i>	474	18.78	535	18.45	633.85	26.65
<i>Harpulia arborea</i>	580.8	31.28	663.75	32.28	744.7	39.92
<i>Hydnocarpus macrocarpa</i>	458.4	23.92	590	28.33	630.11	34.47
<i>Pterospermum reticulatum</i>	407.5	20.12	406.33	22	396.83	22.6
<i>Pterospermum rubiginosum</i>	507.33	16.36	590	20	756.75	21.97
<i>Vitex altissima</i>	713	30.66	751.6	31.91	824.2	36.64
<i>Xylia xylocarpa</i>	554.33	327.2	656.66	31.33	776.76	41.03

Table 4 :Average rate of Growth(Height & Girth in cm)- taken at 6 month intervals for some selected species

Species Name	November - 08		May - 09		November - 09		May -10		November - 10	
	Height	Girth	Height	Girth	Height	Girth	Height	Girth	Height	Girth
<i>Poecilo-neuron indicum</i>	18.5	0.25	35	1.32	101.37	2.4	119.25	2.6	150.75	2.87
<i>Diospyros peregrina</i>	176.26	6.35	224.42	7.27	285.85	9.14	326.71	10.82	378.28	13.98
<i>Semecarpus kathalekanensis</i>	151.24	6.44	172	7.48	235	10.8	253.6	11.16	341	15.1
<i>Mesua ferrea</i>	127.5	3.91	178.33	6	214.5	6.85	237	7.38	231.2	6.96
<i>Lophopetalum wightianum</i>	74.5	1.75	151.75	5.2	252	6	283.5	7.67	436.75	12.6
<i>Hopea ponga</i>	36.25	1.77	46.5	2.45	755	2.62	118.75	2.85	160.5	3.1
<i>Kingiodendron pinnatum</i>	152.83	5.32	198.5	5.75	271.5	7.33	344.83	8.34	386	10.66
<i>Syzygium stocksii</i>	85.75	2.12	111.25	3.8	200.5	5.85	221.25	6.4	330	10.8
<i>Syzygium occidentale</i>	44.8	1.54	64.21	1.14	106.6	2.04	117	2.4	138	2.38
<i>Myristica fatua var. magnifica</i>	167.2	4.7	179.6	5.22	205.3	6	219.6	7.06	269.2	8.5
<i>Gymnacranthera farquhariana</i>	117.7	4	135	4.25	182.75	4.45	202	5.42	241.5	7.1
<i>Gluta travancorica</i>	45.67	2.35	66.57	2.8	107	3.05	112.5	3.6	146.75	3.6
<i>Diospyros ebenum</i>	103.75	3.2	173	5.52	238	6	276.4	8.02	311.6	11.84
<i>Calophyllum inophyllum</i>	318.66	9.13	384.57	13.9	475	16.27	480	17.77	542.75	19.76
<i>Calophyllum calaba</i>	205.88	4.52	241.11	5.84	289.6	7.09	321.6	15.5	370.8	16.4

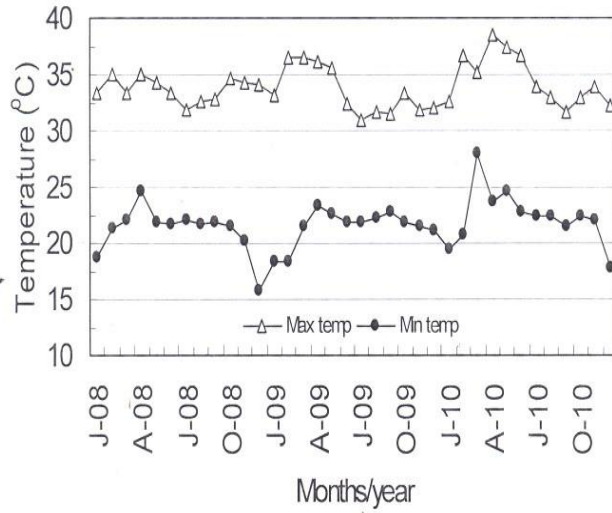
CONCLUSION

The species raised in the conservatory plot were watered at regular intervals at the seedling and sapling stages. Even then, the survival and growth rate of several species were adversely affected due to severe drought during summer.

There were also casualties caused by wild animals like wild boar, spotted deer etc. The spotted deer apart from browsing the seedlings debarked most of the species at sapling and tree stages where the branching of species takes place after considerable height from the ground. It is also observed that the debarking takes place only in those species which possess comparatively rough kind of bark. Uprooting of seedlings by wildboar was also frequent. Damages due to shoot borers are not common. Attack of pathogens and termites were not very prevalent in the arboretum.

The 5 metre spacing seems to be alright because of the mixed pattern of planting of various species belonging to different habit and habitat. It is also proved that introduction of most of the semievergreen and evergreen species in a condition of most deciduous forest will be successful, if one could irrigate and provide timely silvicultural operations like weeding, removal of climbers, manuring etc.

Maximum and Minimum temperatures recorded at FRC Veluppadam during the years 2008-2010



Monthly rainfall data for Veluppadam for the years 2006-2010

