Botanical Excursion M.Sc.-2 (2007-08)

Introduction: -

The Botanical Excursion of M.Sc. Part-2 was to God's own country- Kerala. Prof. Archana Mankad and Prof. Hitesh Solanki organized the excursion for the M.Sc. part-2 students as a part of their syllabus. Kerala has rich biodiversity, many Research Institutes and Plantations of many economically important crops.

22nd -23rd October (in the train**) :-**

This was the day from when the botanical excursion started. According to the train timings we all reached Kalupur station to board Okha-Ernakulam Express train. The train left Ahmedabad at 11:30a.m. and we observed the vegetation all along the track.

TABLE-1:- Following is the list of the plants which we were able to see and identify on the rail tracks:-

No.	Botanical name	family	No.	Botanical name	family
1.	*Acacia nilotica (L.) Willd. ex Delile*	*Mimosaceae*	*19*	*Oryza sativa L.*	*Poaceae*
2.	*Prosopis julifera Linn.*	*Mimosaceae*	*20*	*Saccharum officinarum L.*	*Poaceae*
3.	*Azadirachta indica A. Juss*	*Meliaceae*	*21*	*Saccharum sp.*	*poaceae*
4.	*Ailanthus excelsa (Roxb)*	*Simaroubaceae*	*22*	*Bombax. ceiba Linn.*	*bombacaceae*

5.	*Achyranthus aspera L.*	*Amaranthaceae*	*23*	*Macaranga peltata (Roxb.)*	*Poaceae*
6.	*Sida sp.,*	*Malvaceae*	*24*	*Pennisetum sp.,*	*poaceae*
7.	*Euphorbia sp.,*	*Euphorbiaceae*	*25*	*Euptitorium oilorutwn*	*Asteraceae*
8.	*Mangifera indica L*	*Anacardiaceae*	*26*	*Lantana camara Linn.*	*Verbenaceae*
9.	*Moringa tinctoria*	*Moringaceae*	*27*	*Mussaenda luteola*	*Rubiaceae*
10.	*Vigna sp.,*	*Papilionaceae*	*28*	*Clerodendron inerme (L) Gaertn.*	*Verbenaceae*
11.	*Dioscorea bulbifera L.*	*Dioscoriaceae*	*29*	*Alstonia scholaris (R. BR.)*	*Apocynaceae*
12.	*Vitis sp.,*	*vitaceae*	*30*	*Anacardium occidentale L.*	*anacardiaceae*
13.	*Sterculia urens Roxb.*	*Sterculiaceae*	*31*	*Ficus hispida Linn. (bark)*	*Moraceae*
14.	*Acacia auriculiformis A.Cunn. ex Benth*	*Mimosaceae*	*32*	*Ipomia sp.,*	*convolvulaceae*
15.	*Eucalyptus sp..,*	*Myrtaceae*	*33*	*Cassia fistula Linn.*	*Caesalpinaceae*
16.	*Nicotiana tabacum L.*	*Solanaceae*	*34*	*Ficus benghalensis L.*	*Moraceae*
17	*Musa paradisica Linn*	*Musaceae*	*35*	*Artocarpus altilis Fosberg.*	*Moraceae*
18.	*Cocos nucifera L.*	*Palmae*	*36*	*Lagerstroemia speciosa L.*	*Lythraceae*

We reached Cochin after a 36 hours long but enjoyable journey. There we visited the places of tourist interest.

Place: - **Fort Kochi,**

1. **Chinese fishing nets** :-

Chinese fishing nets (Cheena vala) of Fort Kochi are fixed land installations for an unusual form of fishing - shore operated lift nets. Huge mechanical contrivances hold out horizontal nets of 20 m or more across. Each structure is at least 10 m high and comprises a cantilever with an outstretched net suspended over the sea and large stones suspended from ropes as counterweights at the other end. Each installation is operated by a team of up to six fishermen. The system is sufficiently balanced that the weight of a man walking along the main beam is sufficient to cause the net to descend into the sea. The net is left for a short time, possibly just a few minutes, before it is raised by pulling on ropes. The catch is usually modest: a few fish and crustaceans — these may be sold to passers by within minutes.

TABLE-2:- On the way by bus to the Chinese fishing nets we had seen common plants of that area. The list of that plant is presented in the following table.

No.	Botanical Name	Family	Remarks
1.	*Alstonia scholaris L. R. Br.*	*Apocynaceae*	*Alstonia scholaris* is a small tree that grows up to 40 m tall and is glabrous. The bark is greyish; branchlets are copiously lenticellate.
2.	*Holarrhena antidysenterica Roxb.*	*Apocynaceae*	rees or shrubs with milky latex. Leaves opposite. Cymes terminal or axillary, many flowered. Calyx small, glandular inside at base, glands alternating with lobes. Corolla salverform, tube cylindric, slightly inflated near base, lobes overlapping to right. Stamens inserted near base of corolla tube; filaments short; anthers narrowly ovate.
3	*Eichhornia crassipes (Mart.) Solms*	*Pontederiaceae*	Water hyacinth is one of the most invasive and gregarious aquatic weeds of Kerala.
4.	*Ipomoea quamoclit*	*Convolvulaceae*	It is a very attractive twining morning-glory with smooth stems, lacy leaves and scarlet flowers. The leaves are 3-4 in (7.6-10.2 cm) long and feather-like, finely divided pinnately into threadlike segments. The scarlet red (rarely white) flowers are tubular, about 1.5 in long, and flare out at the mouth into a five-pointed star.
5.	*Ficus benjamina L.*	*Moraceae*	it is a tree reaching 30 m tall in natural conditions, with gracefully drooping branchlets and glossy leaves 6-13 cm long, oval with an acuminate tip.
6.	*Ailanthus excelsa Roxb.*	*Simaroubaceae*	light grey bark with large conspicuous leaf scars and long paripinnate leaves crowded at the end of the branches.
7.	*Albizia lebeck B*	*Mimosaceae*	A medium to large sized unarmed deciduous tree about 20 m in height with an umbrella-shaped crown and grey to dark brown rough irregularly cracked bark; leaves abruptly bipinnate, with glands, fruits long, chlaracteristic pods

8.	*Terminalia L.*	*Combretaceae*	Tree, This genus gets it name from Latin terminus, referring to the fact that the leaves appear at the very tips of the shoots.

TABLE-3:- Following is the list of the plant which we had seen in the garden beside Chinese fishing nets.

No.	Botanical Name	Family	Remarks
1.	*Allamanda cathartica L.*	*Apocynaceae*	Usually woody, evergreen shrubs with vigorous growth, hight 2 metres or more. The leathery leaves are lancelike, pointed, and may either be opposite or in whorls of three or four. The yellow, trumpet-shaped flowers are 5-7.5 cm in diameter.
2.	*Mirabilis jalapa*	*Nyctaginaceae*	shrublike, multi-branched perennials that produce flowers all summer long. The plants are erect and spreading, 2-3 ft (0.6-0.9 m) tall and just as wide. They have numerous branches and opposite, pointed leaves 2-4 in (5-10 cm) long.

2. Mattancherry Palace Museum or Dutch Palace:-

The Dutch palace or Mattancherry Palace was originally built by the Portuguese and presented to the Raja of Cochin, Veera Kerala Varma in 1555. It was later taken over by the Dutch who improved it through extensions and repairs in 1663. Today it is a portrait gallery of the Cochin Rajas. The double storied quadrangular building surrounds a central courtyard containing a Hindu Temple. In the centre is the coronation hall where the Cochin Rajas held their ceremonious coronation. On display here are the dresses, turbans, weapons and palanquins from that era. The highlight of the palace is the 17th century mural paintings of mythological figures and scenes from Ramayana in the tradition of Hindu temple art.

3. NIO (National Institute of Oceanography):-

After lunch we visited the National Institute of Oceanography . It has very small but beautiful and well maintained campus.

TABLE-4:- Following is the list of plants we observed in the NIO campus:-

No.	Botanical name	family	remaks
1	*Lindernia oppositifolia (L.) Mukerjee,*	*Scrophulariaceae*	Herbs, erect, prostrate, or creeping. Leaves opposite; petiolate or sessile; leaf blade margin often toothed or rarely entire; flowers solitary
2.	*Allamanda cathartica L.*	*Apocynaceae*	Usually woody, evergreen shrubs with vigorous growth, hight 2 metres or more. The leathery leaves are lancelike, pointed, and may either be opposite or in whorls of three or four. The yellow, trumpet-shaped flowers are 5-7.5 cm in diameter; cultivated forms have been selected for larger flowers which may also be white, purple, pink or orange in colour.
3.	*Hibiscus mutabillis L.*	*Malvaceae*	shrubby or treelike, Flowers can be double or single and are 4 to 6 inches in diameter
4.	*Cyrtostachys renda Blume*	*Arecaceae*	Commonly known as **red palm.** The brilliant red crownshaft of this tropical species makes it one of the most colorful and ornamental of all palms. Due to it's colour it also known as Lipstick palm. It will grow in shade or full sun and require plenty of water at all times.
5.	*Cycas circinalis L. var. circinalis*	*Cycadaceae*	shrubs evergreen, mostly palmlike; trunk columnar, Leaves borne at apex of trunk, 1(-3) -pinnately compound, spirally arranged; new leaves erect with circinnate leaflets;
6.	*Cryptomeria (L.f.) D.Don*	*Taxodiaceae*	It is a very large evergreen tree, reaching up to 70 m (230 ft) tall and 4 m (12 ft)

			trunk diameter, The leaves are arranged spirally, needle-like, 0.5–1 cm long; and the seed cones globular, 1–2 cm diameter with about 20–40 scales.
7.	*Verbena venosa Gillies & Hook.*	*Verbenaceae*	eaves generally opposite, usually lobed or toothed. Flowers in various shades of purple, small, stalked, in terminal spikes or terminal roundish clusters. Calyx tubular, 5-toothed. Corolla tubular, its lobes 5, the tube long and narrow. Stamens 4, in pairs.
8.	*Croton*	*Euphorbiaceae*	Croton is one of the most colorful evergreen shrub that we grow indoor. The leaves are alternate, linear to broadly ovate, simple or shallowly to deeply lobed, often variegated leaves. There are never two leaves that look the same on a plant and this is why Croton is so attractive.
9.	*Agave americana L.*	*Agavaceae*	It has a spreading rosette (about 4 m wide) of gray-green leaves up to 2 meters (6 ft.) long, each with a spiny margin and a heavy spike at the tip. e spike with a cyme of big yellow flowers, may reach up to 8 meters (25 ft.) in height. The plant dies after flowering, but produces suckers or adventitious shoots from the base, which continue its growth. The average life-span is around 25 years.
10.	*Hibiscus rosa-sinensis L.*	*Malvaceae*	An evergreen shrub, The flowers are large, red, firm, but lack any scent.
11.	*Rosa alba L.*	*Rosaceae*	A rose is a flowering shrub, reaching 2–5 metres tall, occasionally reaching as high as 20 metres by climbing over other plants.
12.	*Bougainvillea spectabilis Willd. 1799*	*Nyctaginaceae*	They are thorny, woody, vines growing anywhere from 1-12 meters tall, scrambling over other plants with their hooked thorns. The leaves are alternate, simple ovate-acuminate, 4-13 cm long and 2-6 cm broad. The actual flower of the

			plant is small and generally white, but each cluster of three flowers is surrounded by three or six bracts with the bright colors associated with the plant, including pink, magenta, purple, red, orange, white, or yellow.

We visited two laboratories in NIO:-

(A) Natural products santifouling laboratory.

Research fellows were working on the biofouling named **Mrs V.P.Limna** had guided us for the following:

What is biofouling? :- it is the procedure in which marine organisms like sponge, bassilarias attach with underground parts of the ships due to which the speed get reduced.

Antibiofouling technique: - Earlier the biocides like TBT (tribulation) were used against the marine organisms. It was harmful to the marine diversity because of that nowadays band is there on the biocides. The alternative way of that was the antifouling paint.

Current trend is the use of natural antifouling compounds. Coral reefs have plenty of diversity. Sponges are on of them which are immobile organism and having the clean surface due to some chemical they secretes. These chemicals we can use as the natural biofouling compounds.

Methodology for the natural biofouling compound standardization: - biofouling marine organisms like mollusks are taken for culture in different sponge abstract mediums and then by observing that in which medium these organisms are less able to grow one can standardize the compounds.

(B) Molecular biology laboratory: -

Here **Kiran Krishna** , JRF in NIO informed us about the genetic diversity of marine organism. Of the two 2 main types of ribosomal structure 70S and 80S, the 70S type of ribosomes are found in bacteria, which can split in to the 2 type 50S and 30S type.For prokaryotic organisms they used the 16S part of gene which is not prone to mutation and for the study of eukaryotic bar-coding of cytochrom oxidase – I present in the mitochondria is done. Strand of gene were made to illuminate by inserting florescent dyes like HTP between the N.B.'s

Another method employed was thermal based; as G=C base is more thermo labile in comparison to A=T.

Electrophoresis and many other methods of bio-chemical analysis were undertaken for the identification of marine diversity.

4. Central Marine Fisheries Research Institute (CMFRI) :-

There was a short time visit to the CMFRI located besides the NIO. A small stopover had made in to the museum and conversant about the sponges which's chemical abstract called AZT uses as the anti-HIV. Wonderful knowledge was shared by **Mrs. P. H. Geeta and Mr. Balachandran**.We had a look on the different algae coral riff's preserved specimens.

TABLE-5:- some details of the data is as follows:

Type of plant	World	India	Commercial
Sea weeds	10,000	744	49
Sea grass	163	17	17

Tea break:- During the way to tea break we have seen following plants on the road side.

TABLE-6:-

No.	Botanical Name	Family	Remarks
1	*Ravenala madagascariensis Sonnerat*	Musaceae	It is called the travelers palm because the stems hold rainwater that can be used as an emergency drinking supply. The enormous paddle-shaped leaves are borne on long petioles in a distinctive fan shape aligned in a single plane. The plant is widely cultivated for its distinctive habit and foliage in tropical and subtropical regions.
2	*Bignonia megapotamica Spreng.*	Bignoniaceae	An evergreen tree of medium sizes growing up to a height of 10m and produces clusters of light mauve flowers. It is a quick growing tree in warm humid climate.

			The plant remains in bloom almost throughout the year but larger number of flowers develops from March to May.
3	*Ficus benjamina L.*	Moraceae	it is a tree reaching 30 m tall in natural conditions, with gracefully drooping branchlets and glossy leaves 6-13 cm long, oval with an acuminate tip.

5. Visit to Jawaharlal Nehru garden:-

TABLE-7:-We had visited the the garden and listed the plants cultivated there and they are as follows:-

No.	Botanical name	Family	Remarks
1	*Plumeria alba L.*	*Apocynaceae*	The leaves of P. alba are quite narrow and corrugated, possess poisonous, milky sap, Plumeria flowers are most fragrant at night in order to lure sphinx moths to pollinate them. The flowers have no nectar, and simply dupe their pollinators.
2	*Hibiscus rosa-sinensis L.*	*Malvaceae*	An evergreen shrub, The flowers are large, red, firm, but lack any scent.
3	*Cocos nucifera L.*	*Areceae*	It is the only species in the genus Cocos, and is a large palm, growing to 30 m tall, with pinnate leaves 4-6 m long, pinnae 60-90 cm long; old leaves break away cleanly leaving the trunk smooth. The term coconut refers to the fruit of the coconut palm.
4	*Rosa alba L.*	*Rosaceae*	A rose is a flowering shrub, reaching 2–5 meters tall, occasionally reaching as high as 20 meters by climbing over other plants.
5	*Crescentia cujete*	*Bignoniaceae*	The species are small trees growing to 10 m tall, and producing large spherical fruits up to half a meter in diameter.
6	*Acacia auriculiformis*	*Mimosaceae*	is a fast-growing, crooked, gnarly and thorny tree . It grows up to 30m tall .

	A.Cunn. ex Benth.		
7	*Tectona grandis L.*	*Verbenaceae*	They are large trees, growing to 30-40 m tall, deciduous in the dry season.
8	*Mangifera indica L.*	*Anacardiaceae*	Mango trees (Mangifera indica) reach 35-40 m in height, with a crown radius of 10 m. The leaves are evergreen, alternate, simple, 15-35 cm long and 6-16 cm broad; The flowers are produced in terminal panicles 10-40 cm long; each flower is small and white with five petals 5-10 mm long
9	*Delonix regia (Boj. ex Hook.) Raf.*	*Caesalpiniaceae*	Flame-red flowers, 4-5 in (1.2-12.7 cm) across. They have four spoon shaped spreading scarlet or orange-red petals about 3 in (7.6 cm) long, and one upright slightly larger petal which is marked with yellow and white.
10	*Peltophorum ferrugineum (Decne.) Benth*	*Caesalpiniaceae*	A tree 8-15 m high, with a spreading crown... The leaves have 4-15 pairs of pinnae, each with 8-20 pairs of leaflets 8-30 x 3.5-10 mm and rounded or emarginate at apex. The fragrant flowers have canary-yellow petals 1-2 cm long, with frilly margins; the reddish brown fruit is 5-11.5 cm long and 2-2.7 cm broad, the valves at length splitting lengthwise through the middle."
11	*Bougainvillea spectabilis Willd. 1799*	*Nyctaginaceae*	They are thorny, woody, vines growing anywhere from 1-12 meters tall, scrambling over other plants with their hooked thorns. The leaves are alternate, simple ovate-acuminate, 4-13 cm long and 2-6 cm broad. The actual flower of the plant is small and generally white, but each cluster of three flowers is surrounded by three or six bracts with the bright colors associated with the plant, including pink, magenta, purple, red, orange, white, or yellow.
12	*Cassia fistula L.*	*Caesalpiniaceae*	Cassia fistula is widely grown as an ornamental plant in tropical and subtropical areas. It blooms in late spring (May on the northern, November on the southern

			hemisphere) mor ; flowering is profuse, with trees being covered with yellow flora, with almost no leaf being seen.
13	*Tecoma stans (L.) Juss. ex Kunth*	*Bignoniaceae*	The perennial shrub Tecoma stans is known by the common English names Yellow Trumpetbush, Yellow Bells an attractive plant which is cultivated as an ornamental. It has sharply-toothed, lance-shaped green leaves and bears large, showy, bright golden yellow trumpet-shaped flowers.
14	*Lagerstroemia speciosa (L.) Pers.*	*Lythraceae*	It is a small to medium-sized tree growing to 20 m tall, with smooth, flaky bark. The leaves are deciduous, oval to elliptic, 8-15 cm long and 3-7 cm broad, with an acute apex. The flowers are produced in erect panicles 20-40 cm long, each flower with six white to purple petals 2-3.5 cm long. It is also widely cultivated as an ornamental plant.
15	*Ficus religiosa L.*	*Moraceae*	Peepal is a large, fast growing deciduous tree. It has a heart shaped leaves. It is a medium size tree and has a large crown with the wonderful wide spreading branches. The figs are ripening in the month of May. The figs which contain the flowers grow in pairs just below the leaves and look like the berries. Its bark is light gray and peels in patches. Its fruit is purple in colour. It is one of the longest living trees.
16	*Albizia amara (Roxb.)*	*Mimosaceae*	Smooth, dark green, scaly bark. It resembles the acacias but lacks thorns. The leaves are pinnately compound, with 15-24 pairs of small, linear leaflets, on 6-15 pairs of pinnae. The yellow, fragrant and globose flowers are in clusters.
17	*Phyllostachys aurea Car. ex A. & C.*		**Golden bamboo** culms can reach a height of 8 to 10 meters. The alternate, grass-like, leaves are lanceolate; 1.5 dm long and 1 to 2 cm wide and

			often in fan clusters. Golden bamboo flowers infrequently, may not flower for several decades lower shoots and branches with loose papery sheaths cover the ground when shed.

Next day we visited University at Cochin.

1. <u>CUSAT</u> :-(Cochin **U**niversity of **S**cience **A**nd **T**echnology**)**

The University of Cochin reorganized as Cochin University of Science and Technology (CUSAT) was established in February 1986.

Dr. A.V. Sharma gave us a warm welcome and explained the mandate of the this institute.

Basically in CUSAT they are working on the benthic i.e. algae, mollusks and other miscellaneous sediments. They are using formalin to preserve that sediments found in between 200-1000 meter and uses rose bengol stain to check the viability of the sediments.

Other intrusting thing we noticed that they have design and developed a special machine called **<u>grabs</u>** to obtain sediments from deep sea.

In CUSAT we observed the following instruments.

1. UV visible spectrophotometer
2. Electrophoresis unit
3. Atomic absorption spectrophotometer
4. Particle size analyzer
5. HPLC
6. Elecrofocusing unit
7. Fluorescence spectrophotometer
8. Electronic balance
9. PH meter
10. Deep freezer
11. Refrigerator
12. Centrifuge machine

Then **DR.Abhilash** gave us a wonderful quick look on the research they are doing. Their main work is on the antibiotic resistance bacteria. The viruses like bacteriophage and vibriod are used for the infection. The infected bacteria were then studied for antibiotic compounds and other bioactive compounds.

Here we have observed the following instruments.

1. Liquid sanitation counter (checking beta radiation) 2. HPCL-nurotransmitis 3. PCR
4. Real PCR 5. Cooling centrifuge 6. Spectrophotometer Laminar air flow
7. Phase contrast microscope 8. Autoclave 9. Electron microscope

After this academic visit we went to see a forest area called Vazachal forest area. The range was Charapa.

In this area we observed plant sp, like *Helicteris isora, Macaranga peltata, Piper longum* etc .

Vazachal forest area: **Vazachal fall, Charapa fall and Athirrapalli water fall** :Athirrapalli falls are formed on river Chalakudy which is 144 Km long, 1704 Km Sq.Km. The most common plant we have seen here were

Rincoglosum notorianum, *Terminalia peniculata,*
Peperomia sp. *Xylia xylocarpa.*
Mallotus philippensis Lam. *Macaranga peltata Roxb*
Dalbergia latifolia roxb.

Next Day we visited

1. KFRI:- (**K**erala **F**orest **R**esearch **I**nstitute)

Director Dr. Gananharan has welcomed us and introduced with whole institute.

The Kerala Forest Research Institute (KFRI) located in the Peechi is established under the Science and Technology Policy adopted by the Government of Kerala as an autonomous institution to undertake research in areas like forestry, biodiversity etc.,

The main objective of the Centre is to collect seeds of superior trees/stands, process, grade, store and supply to KFD and other government departments, non governmental agencies, farmers and other interested in seed of forest tree species for propagation.

Facilities available in KFRI

It has facilities for processing, grading and storage of seeds at low temperature, seed testing for pests and diseases and certification for seed weight, purity and viability.

Species for which seeds are available

Seeds of teak (*Tectona grandis*), rosewood (*Dalbergia sissoides* and *D.latifolia*), bamboo, rattan and several other tropical species in Kerala will be available for sale. The list of tree seeds was provided on request.KFRI has collaboration with several institutes like

TBGRI (Tropical Botanical Garden and Research institute: 1979**), CEE** (Center for Ex Science studes, Tiruvantanpuram: 1978), **CWRDM** (Center for water Resource Development and Management, Kozikore: 1978) etc.

- Different division of KFRI working are as follows:-
  1. Sustainable natural and plantation forest management (SNPF)
  2. Forest ecology and biodiversity conservation(FEBC)
  3. Forest protection(FP)
     - Forest and non forest products like gums, resins, honey, lack etc,.
     - Medicinal plants development
  4. Forest utilization
  5. Forest and human dimensions (FHP)
  6. Forest information management system

We had a chance to seethe following in KFRI:-

(A) **Seed center:-**

Dr. Chacko and his student Ms. Neetu Das informed us about this seed center.

Seed processing unit:-

- The general superior seed stands are established by progeny trials.
- Then the seeds are processed through following steps

1. **Selection: -** initial selection of seeds is based on their moisture content. Good quality seeds costs Rs.1800-200 Per Kg. standards of the seeds are based on their performance. Mostly in the case of teak the seeds more then 9mm considered as good quality seeds but variations are there.
2. **Cleaning:**- it is done after selection
3. **Tagging:** - seeds are then sent for tagging without it seeds are useless.
4. **Packing and Storing:** - seeds are packed in air tight containers and stored.
    - Short term storage method: - In this the seeds are stored for maximum 2yrs at 45% humidity.
    - Long term storage method: - In this type seeds are stored for 5 or more then 5 yrs. Again two categories are there in long term storage
        1. Orthodox seeds:- these are dried and stored at low temperature.
        2. Recalcitrant: - some seeds like saag are difficult to store because such seeds die when dehydrated.

(B) Biotechnology division in KFRI: -

This division is mainly working on Bamboos and Teak trees. The juvenile shoots from the Provo lens is used for cloning. Propagation of these trees is mainly done by cloning. The workers in this division use polypropylene pockets instead of bottles for growing the clones. NPV and HP are insect resistant genetically improved varieties of teak. Similar improved clones of eucalyptus and bamboo clones are also produced and propagated. ALFP and microclines are used as chemical markers for achieving DNA sequence.

(C) Medicinal fern garden in KFRI: - ferns can grow as epiphytes as well as terrestrial plants. More then 90% of ferns are medicinally important. Dr. M. Ramesh working in KFRI has given the following ferns medicinal importance.

TABLE-8:-List of ferns we have seen in garden:-

No.	Botanical name	Family	Medicinal and other uses
1	*Drynaria laurentii (Christ.) Hieron.*	*Polypodiaceae*	It is having 2 type of leaves. And uses in snake bite.

2	*Lygodium flexiosum Lygodium flexuosum (L.) Sw. J.Bot.(Schrader)*	*Lygodiaceae*	Stem and rhizomes are used in stomachache
3	*Angiopteris*	*Marattiaceae*	It is having antimicrobial activity
4	*Marselia quadrifoliata*	*Marsileaceae*	Whole plant paste is soaked in hot water and is used for toothache.
5	*Nephrolepis*	*Nephrolepidaceae*	Herb is used against cough and skin diseases. It is also one of the best over all plants at removing gaseous toxins from the air, including formaldehyde
6	Microsorium punctatum (L.) Copel	Polypodiaceae	
7	Dryopteris sp. Adans.	Dryopteridaceae	widely used as a vermifuge, also used as an abortifacient
8	Diplazium esculentum (Retz.) Sw.	Athyriaceae	Addible fern, It is probably the most commonly consumed fern, and is quite tasty, giving it the name "vegetable". It is used in many oceanian recipes, and made into salads and stir fry
9	Lycopodium	Lycopodiaceae	Used as a covering for pills and explosives.

After visiting fern cage we discussed our queries with the experts specially about biophytum weed. The *Biophytum condolianum* is a rain weed found all over in Kerala. The other useful medicinal plants we have seen are *Napa fruiticosa, Chamaedora metallis* and *Strichnous nnux-vomica* in KFRI campus.

Then we had a lecture in seminar hall of KFRI:-

The seminar was on the tree identification. For a good identification of any plant sp. it necessary to having a good knowledge of terminology. The ways by which one can identify the plants are monograph, local floras etc. here they have developed some keys for the identification of plants. For example, trees: more then 4 meter, buttresses, type of root weather Arial or stilt, prickles or thorns present or absent.

After a south Indian Lunch at KFRI our trip proceeded towards **Kerala Agricultural University Education Association (KAUEA).** Here we have seen the ornamental plant cultivation fields. Large area with plenty of beautiful flowering plants has been cultivated over here. The plants like Dendrobium, Arabidia magnifica, Heliconia are grown in the open field while plants like anthurium, different kinds of orchid, gerberas which require special treatment and controlled conditions are grown in the green house cages.

Then we visited T**.V.Vishvanathum memorial herbal park**.

2. T.V.Vishvanathum Memorial Herbal Park :-

TABLE-9:-list of the plants we have seen there.

No.	Botanical name	Family	Remarks
1	Ampelocissus arnottiana Planch	Vitaceae	Climbers, woody, hermaphroditic, Tendrils unbranched, Leaves simple. Inflorescence a panicle, leaf-opposed and tendril-bearing. Petals 4 or 5, spreading, free. Stamens 4 or 5 .
2	Hemidesmus indicus R. Br.	Asclepiadaceae	It is a slender, laticiferous, twining, sometimes prostrate or semi-erect shrub. Roots are woody and aromatic. The stem is numerous, slender, terete, thickened at the nodes. The leaves are opposite, short-petioled, very variable, elliptic-oblong to linear-lanceolate. The flowers are greenish outside, purplish inside, crowded in sub-sessile axillary cymes.

3	Mimusops elengi L.	Sapotaceae	This is an evergreen tree with 50 feet in height. The bark is dark grey in color. Leaves- Shiny, smooth and oval leaves are 2 to 4 inch long and 1 to 2 inch wide. .flower- Yellowish, white and fragrant flowers are of one inch diameter. Flowering occurs in April and May.
4	Emblica ribes Bur,	Euphorbiaceae	Its principal constituents are embelin, quercitol and fatty ingredients. The dried fruits are used in decoction for fevers and for diseases of the chest and skin. The fruit also shows antibacterial activity.
5	Calophyllum inophyllum L.	Guttiferae	large evergreen tree ,It is a low-branching and slow-growing tree with a broad and irregular crown. It usually reaches 8 to 20 m in height. The flower is 25 mm wide and occurs in racemose or paniculate inflorescences consisting of 4 to 15 flowers.

3. NBPGR (National Bureau of Plant Genetic Resources):-

Dr. Z.Abraham inrtroduced us with functions of this institute.

- **The National Bureau of Plant Genetic Resources** has its Headquarters at **New Delhi, NBPGR** functions under the administrative control of the Crop Science Division of the **ICAR.**
- This station was established in **1977** in the Kerala Agricultural University campus near Pineapple Research Station on the Mannuthy-Chirakkakode road with a farm area of 10.4 ha.
- The **Bureau has four Divisions, two units, three cells and an experimental farm at its Headquarters in New Delhi** and **11 regional/ base/ satellite stations** located in different phyto-geographical zones of India.
- **Plant Exploration and Collection Division** has the objectives **to plan, coordinate and conduct explorations for collecting germplasm**. Germplasm Evaluation Division is entrusted with the prime responsibility of characterization and evaluation of all the indigenous and exotic germplasm collections for their field performance.

- Resistance to biotic/ abiotic stresses and phytochemical attributes along with maintenance and regeneration.
- It also undertakes the quarantine of material under export and issues the phytosanitary certificate.
- Germplasm Exchange Unit has the responsibility of introducing genetic resources of diverse crop plants and their wild relatives and distributing the same within the country, and also exports the germplasm.
- There is also a Tissue Culture and Cryopreservation Unit, with the main objective to conserve economic plants, for which conventional methods of storage are unsuccessful or inadequate, through in vitro and Cryopreservation techniques.

Next Day we collected weeds from different plantations on the way. This was to be submitted as our assignment.

1. <u>Pineapple Plantation</u>: - we spent modest time here to collect weeds like

<u>TABLE-10:-</u> List of weeds.

No	**Botanical name**	**Family**	**remarks**
1	*Cleome sp. L*	*Capparaceae*	Small herb, not more then 10cm. having minute purple flwer in axilary cyme.
2	*Piper L.*	*Piperaceae*	Woody perennial climbers with swollen nodes and stipule. The leaves are aromatic or had a pungent smell. The flowers were very small, arranged in spikes and had no perianth. 2-6 stamens.
3	*Rincogllosum notorianum*		
4	*Peperomia pellucida (L.) HBK.*	*Pipraceae*	Delicate herbs of moist places, becoming weedy along paths during the rainy season; leaves alternate, simple, broadly cordate, margins entire; flowers minute, embedded in narrow spikes arising from the leaf axils.
5	*Sida L*	*Malvaceae*	Mostly herb or small shrubs, flowers small yellow colored. Cosmopolitan.

2. <u>Rubber Plantation</u>: -

Here we got a very good opportunity to see the rubber plantation.

- Rubber is basically latex obtained from a tree *Hevea brasilensis*.
- Nearly 5-25 yr old tree is used for the latex extraction.
- The latex is harvested early in the morning. Two horizontal scares are made on the trunk.
- The latex come out which is collected in the plastic container. Then it transfer for further procedure as bellow:-

1. The latex is filtered
2. Water is added
3. Chromic acid is added
4. Allow to dry
5. Drown in to rubber sheet

- In rubber field the plants like legumes are intercropped with rubber to provide enough nitrogen to the rubber plant and also to check weeds growth. bordex mixture is also added as fungicide.

After a short overlook we proceeded towards Munnar.

TABLE-11:- On the way we have seen plants like

No	Botanical name	Family	Remarks
1	*Cassia alata L.*	*Caesalpiniaceae*	Candle Bush or *Senna alata* is an ornamental flowering. The shrub stands 3-4 m tall, with leaves 50-80 cm long. Its seed are distributed by water or animals.
2	*Cassia tora auct. non L.*	*Caesalpiniaceae*	Its leaves, seeds, and root are used in folk medicine, primarily in Asia. It is believed to possess a laxative effect, as well as to be beneficial for the eyes.
3	*Peperomia pellucida (L.) HBK*	*pipraceae*	Delicate herbs of moist places, becoming weedy along paths during the rainy season; leaves alternate, simple, broadly cordate, margins entire; flowers minute, embedded in narrow spikes arising from the leaf axils.

4	*Mimosa pudica L.*	*mimosaceae*	Stem is erect in young plants, but becomes creeping or trailing with age. The stem is slender, branching, and sparsely to densely prickly, growing to a length of 1.5 m (5 ft). The leaves are bipinnately compound, with one or two pinnae pairs, and 10-26 leaflets per pinna. petioles prickly. Stalked pale pink or purple flower heads arise from the leaf axils.
5	*Colocasia Schott*	*Araceae*	They are herbaceous perennial plants with a large rhizome on or just below the ground surface. The leaves are large to very large, 20-150 cm long, with a sagittate shape. The elephant's-ear plant gets its name from the leaves, which are shaped like a large ear or shield.
6	*Macaranga peltata (Roxb.) Müll.Arg.*	*Euphorbiaceae*	Small trees; Leaves: petiole 11–19 cm long, slender, c. 3 mm in diameter, round, slightly striate, weakly furfuraceous, peltate, with nectaries on upper leaf surface Staminate inflorescences small racemes, bracts inconspicuous, ovate .
7	*Clerodendron paniculatum L.*	*Verbenaceae*	They are shrubs, lianas, and small trees, growing to 1-12 m tall, with opposite or whorled leaves,
8	*Chromolaena odorata (L.) R. M. Syn:Eupitorium*	*Asteraceae*	Eupatorium [Chromolaena odorata (L.) King and Robinson] is a noxious weed.
9	*Ixora coccinia L*	*Rubiaceae*	evergreens and shrub, The flowerhead is spherical and consists of a number of red, four-petalled flowers .
10	*Hibiscus rosa-sinensis L.*	*malvaceae*	An evergreen shrub, The flowers are large, red, firm, but lack any scent.
11	*Costus L.*	*Costaceae*	The large inflorescence is comprised of a series of hard red bracts similar to a pineapple top in shape with small bright yellow flowers peeking out. It can produce both basal and terminal inflorescence of 6" to 12" in length. Can grow 7'

12	*Helicteres isora Linn*	*Sterculiaceae*	
13	*Lantana camara L.*	*Verbenaceae*	Some household furniture, such as tables and chairs are made from the stalks, or the small branches are bundled together to make brooms. Some Lantana cultivars are ornamentals and these tend to have small herbaceous stems.
14	*Stachytarpheta jamaicensis*	*Verbenaceae*	Height: 4 to 8 feet, Plant habit round, dense, Growth rate fast, Texture medium, Foliage, opposite, simple, serrate, ovate, semi-evergreen, less than 2 inches; Flower, pink; blue, summer flowering;

We collected ferns like *Blechnum, Glychenia, Lycopodium, Angiopteris, Tectaria* etc.

TABLE-12:- List of plantations on road side.

No	**Plantation**	**Family**	**remarks**
1	Paddy (*Oryza sativa*)	*Poaceae*	Domesticated rice are *Oryza sativa* and *Oryza glaberrima*. Rice provides more than one fifth of the calories consumed worldwide by humans. Rice is grown as a monocarpic annual plant. Cultivation:- The traditional method for cultivating rice is flooding the fields with or after setting the young seedlings.
2	Tapioca (Cassava)	*Euphorbiaceae*	Tapioca is essentially a flavorless starchy ingredient, produced from treated and dried cassava (manioc) root and used in cooking. It is similar to sago and is commonly used to make a milky pudding similar to rice pudding. Purchased tapioca comprises many small white spheres each about 2 mm in diameter These tapioca pearls are made mostly of tapioca starch, which comes from the

			tapioca, or bitter-cassava plant.
3	Elaichi (Elettaria cardamom)	Zingiberaceae	The name cardamom (or cardamon) is used for herbs within two genera of the ginger family Zingiberaceae, namely Elettaria and Amomum. Both varieties take the form of a small seedpod, triangular in cross-section and spindle-shaped, with a thin papery outer shell and small black seeds. Elettaria pods are light green in color.
4	Coconut (Cocos nucifera L.	Palmae	The Coconut Palm (Cocos nucifera) is a member of the Family Arecaceae (palm family). It is the only species in the genus Cocos, and is a large palm, growing to 30 m tall, with pinnate leaves 4-6 m long, pinnae 60-90 cm long; old leaves break away cleanly leaving the trunk smooth. The term coconut refers to the fruit of the coconut palm.
5	Sopari (Areca catechu) L.		Areca catechu, known commonly as Betel palm. It is a medium-sized tree growing to 20 m tall, with a trunk 20-30 cm in diameter. The leaves are 1.5-2 m long, pinnate, with numerous, crowded leaflets. Areca catechu is grown for its economically important seed crop, the Betel nut.b

Thus the study of plants - their collection kept us occupied and we reached Munnar. Munnar is one of the most popular hill stations in India, Munnar (Kerala) is situated at the confluence of three mountain streams - Mudrapuzha, Nallathanni and Kundala. Located at 1600 M above sea level. Sprawling tea plantations, picture book towns, winding lanes, trekking and holiday facilities make Munnar a unique experience. Munnar is essentially a tea town. The visitor is greeted with miles and miles of unending tea plantations on entry into Munnar. Among the exotic flora found in the forests and grasslands.

Our Day started with the cool morning air filled with and humid dew. We had a short visit to the Kerala forest and wild life department present near our base camp. It was wild life information center and office of the wild life warden. We were planning to go for Eravikulam national park which is one of the most beautiful park of south India.

1. Eravikulam National Park:-

Eravikulam National Park is 97 sq. km. in extent, situated along the crest of the Western Ghats in the High Ranges of Idukki district. Eravikulam Wildlife Sanctuary is a sanctuary set up for the preservation of the endangered **Nilgiri Tahr**. The main inhabitant of the park is Nilgiri Tahr. Now the park has the largest known population of Tahr's existing in the world. The park also shelters Atlas Moth, Elephants, Sambhar's, Gaurs, Lion-tailed Macaque, Nilgiri, Langur, Tigers and Leopards. The park exhibits the breathtaking natural splendor of rolling grasslands and exotic flowers. Anamudi, the highest peak south of Himalayas, towers over the sanctuary in majestic pride. The Atlas Moth, largest of its kind in the world, is a unique possession of the park.

Flora in Eravikulam National Park:

Three major types of plant communities are found in the Park - grasslands, shrublands and forests. The terrain above 2000m is covered primarily by grasslands. However, there are numerous small patches of forests in hollows and gullies in these areas. The deeper valleys are extensively forested. Shrublands predominate along the bases of the cliffs and interspersed in rocky slab areas. The antibacterial *Eupatorium glandulosum* is found here. The special feature of forest type that we learnt from our teachers is that the forest type present over here is known as sholas. **Sholas**:- Sholas are tropical montane forests that are found in the valleys and folds of mountains. The word ‘shola’ is taken from the Tamil word sholai meaning any evergreen forest and the word has often been used to name lower forests.

2. Blossom park:-

After lunch we went to another astonishingly beautiful flower garden named Blossom Park. It is 2.5km from Munnar and is a beautiful garden with rare variety of plants and flowers. Collection of exotic and local plants and its cultivation was amazing.

TABLE-13:- List of ornamental plants we have seen there:

No	Botanical name	Family	Remarks
1	*Salvia pratensis L.*	*Lamiaceae*	It is a herbaceous perennial plant growing to 1-1.5 m tall. The leaves are arranged in opposite pairs, the leaves on the lower part of the stem up to 15 cm long, decreasing in size higher up the stem. The flowers are dark blue-purple, rarely pink or white.
2	*Rosa alba L.*	*rosaceae*	A rose is a flowering shrub, reaching 2–5 metres tall, occasionally reaching as high as 20 metres by climbing over other plants.
3	*Dahlia*	*Asteraceae*	Dahlia plants range in height from as low as 12" to as tall as 6-8 .The flowers can be as small as 2" or up to a foot in diameter.
4	*Anthurium*	*Araceae*	Several species are popular in the florist trade as pot plants or cut flowers and for interior decoration. leaves large, velvety, darkgreen and silvery white venation. .
5	*Gerbera*	*Asteraceae*	Gerbera species bear a large capitulum with striking, two-lipped ray florets in yellow, orange, white, pink or red colors. Gerbera is commercially important. It is the fifth most used cut flower in the world (after rose, carnation, chrysanthemum, and tulip). It is also used as a model organism in studying flower formation. Gerbera contains naturally occurring coumarin derivatives
6	*Acalypha wilkesiana L.*	*Euphorbiaceae*	Shrub, 10 ft tall The leaves are alternate, elliptic to oval, serrate, 5-8 in long and multi-colored. The flowers are small and inconspicuous, hanging in 4-8 in catkinlike racemes usually hidden in the foliage.

7	*Spathodea campanulata P.Beauv.*	*Bignoniaceae*	7-25 m tall, This tree is planted extensively as an ornamental tree throughout the tropics and is much appreciated for its very showy reddish-orange or crimson (rarely yellow), campanulate flowers. It has the potential to become an invasive species though.
8	*Helichrysum Mill.*,	*Asteraceae*	These are annuals, herbaceous perennials or shrubs, growing to a height of 60-90 cm.Their leaves are oblong to lanceolate. They are flat and pubescent on both sides. The bristles of the pappus are scabrous, barbellate, or plumose.
9	*Lilium L.*	*Liliaceae*	The genus Lilium are herbaceous and important as large showy flowering garden plants, and in literature. Some of the bulbs have been consumed by people. The species in this genus are the true lilies, while other plants with lily in the common name are related to other groups of plants.
10	*Canna indica L.*	*cannaceae*	The species have large, attractive foliage and horticulturists have turned it into a large-flowered, brash, bright and sometimes gaudy, garden plant. In addition, it is one of the world's richest starch sources, and is an agricultural plant.
11	*Lupinus L.*	*fabaceae*	The species are mostly herbaceous perennial plants 0.3-1.5 m (1-5 ft) tall They have a characteristic and easily recognised leaf shape, with soft green to grey-green leaves which in many species bear silvery hairs, often densely so. The flowers are produced in dense or open whorls on an erect spike.
12	*Celosia cristata L.*	*Amaranthaceae*	The plant often grows up to 1 foot in height, though many are smaller. The leaves are green or bronze/maroon, depending upon the cultivar. flowers red colored

13	*Dracaena Vand. ex L.*	*Dracaenaceae*	The tree is characterised by a single or multiple trunk growing up to 12 m tall (rarely more), with a dense umbrella-shaped canopy of thick leaves. It grows slowly, requiring about ten years to reach 1 m tall
14	*Zinnia L.*	*Asteraceae*	Zinnia leaves are opposite and sessile, with a shape ranging from linear to ovate, and pale to middle green in color. Flower: dome shape, with the colors white, chartreuse, yellow, orange, red, purple, and lilac.
15	*Tagetes erecta*	*Asteraceae*	This plant reaches heights of between 50 and 100 cm. The Aztecs gathered the wild plant as well as cultivating it for medicinal, ceremonial and decorative purposes.
16	*Cleome hassleriana*	*Cleomaceae*	height 150 cm, leaves spirally arranged palmately compound, with five or seven leaflets, the leaf petiole up to 15 cm long. The flowers are purple, pink, or white, with four petals and six long stamens. Flowering : spring to early fall .It is commonly cultivated as an **ornamental plant**.

The next day we started from Munnar to reach Thekadi and see the famous Spice Gardens. On the way we visited Institutes:

1. ICRI (Indian Cardamom Research Institute):-

The Indian Cardamom Research Institute (ICRI) is a part of Spice Board, Ministry of Commerce and Industry, Government of India. (1978).

It has three major Regional Research Stations:

1. RRS, Saklespur, Karnataka (1980)
2. RRS, Thadiankudisai, Tamilnadu (1980)
3. RRS, Gangtok, Sikkim (1986)

In the seminar we were informed about the two different types of cardamom i.e. large and small. The small cardamom is known as *Eletaria cardamomum* and large one called *Amomum subelatum*. (Family: - Zingibaraceae). Both posses pseudo-stem called tiller and the true stem is

called rhizome. The two are differentiated on the basis of their inflorescence. The large cardamom possess panicle raceme inflorescence which opens after 7-8 months; where as the small cardamom has a conical spike on which the flower are arranged in 2-3 whorls. The flowers open in 15-20 days. Both are pollinated by honey bees other then cardamom research programs on other spices like black pepper, ginger, turmeric, chillies, tree spice and other organic spices are also carried on. All spice controls the production of germs and pests and are antiseptics.

Other divisions of research in the Institute are:-

1. **Agronomy and Soil science: -** Soil testing and analysis for nutrition and chemicals.
2. **Crop improvement: -** organic crops are improved by various techniques.
3. **Biotechnology division: -**
    - Germplasm conservation
    - A variety with good quality and disease resistance are produced and relies.
      E.g. ICRI-1 (karalla); ICRI-2 (Karalla); ICRI-3 (Karnataka) and ICRI-4 (Tamilnadu) are verities produced through selection and ICRI-5 and ICRI-6 are hybrid varieties.

4. Entomology: - invading insect resistance in plants [EPN- entemo pathogenic nematode]

5. Plant pathology: - protection of plant from infection like fusarium disease in cardamom, pythium; and some diseases as well.

6. Transfer of technology: - seed treatment with VAM

7. Post harvest technology: - removing moisture using dryers, fixing chlorophyll.

8. Pathology division: - in this division, antagonistic fungus against diseases was used as bio-pesticides. E.g. (1) formulation of *Trichoderma harzianum* (green fungus) is used to cure white rust disease by *Fussarium oxysporium*. (2) *Pythium* for stem rot. Similarly, some antagonistic bacteria are also used to certain diseases.

After a knowledgeable visit to ICRI we proceeded for Abraham's spice garden.

2. ABRAHAM'S SPICE GARDEN

This spice garden is totally organic and is run by Abraham's family. Mr. Varkey Varkey who is the grand father of Mr. Abraham started the farm in 1952. They are using natural methods instead of pesticides. We were informed here about plenty of ornamental plants, spices, woody plants like fire and timber yielding trees, and fruits including many varities of banana, brinjal,etc. . A comprehensive tour took 2 hours or even longer. Some of the significant plants there wer-

1. Heliconia
2. variety's of orchid
3. variety's of brinjal (red brinjal; he has developed by hybridization)
4. Piper longum
5. all spices
6. Caliandra hemetocephala
7. chilli
8. Cardamom
9. Desmodium (telegram plant; curves with light)
10. Xylia xylocarpa

Next day We visited the Central Tuber Crops Research Institute (CTCRI) at Sreekaryam in Thiruvananthapuram .

1. CTCRI (Central Tuber Crops Research Institute): -

Lecture by Dr. Asha Vijayan in seminar hall of CTCRI:

Established in 1963, the Institute has grown in stature over the years, gaining international recognition in the process. The research activities are mainly focused on tropical tuber crops such as cassava (tapioca), sweet potato, yam, elephant foot yam and Colocasia. The institute has developed technologies to enhance the productivity and utilization potential of the tuber crops. The institute maintains a rich diversity of germplasm of all tuber crops .Over the years, the CTCRI has developed improved varieties of cassava, sweet potato, yam, colocasia and amorphophallus. Scientists at the institute have standardized agro techniques and soil nutrient management practices to maximize production. Integrated pest and disease management strategies have been evolved. Scientists have also come up with post-harvesting techniques for tuber crops.

Until now they have developed 6 varieties of cassava (i.e. shrivishakhanum, sakia, prakash etc.) and more then 10 varieties of yam. (i.e.,shrilata, shrishubra, shridrania, shridhar etc). we also informed about the intercropping of banana or coconut with yam will gives good results and better production. This practice also gives protection against viruses and pests.

Production of sago:-

The process involves following steps:-

1. harvesting tuber through pedol machines.
2. Clipping:- either through pedal operation or through manual machine.
3. peeling of tubers
4. Drying through electric driers.
5. starch extraction trough enzymatic treatment.
6. Final process to make sago.

2. Kerala University Medicinal Garden:-

Dr. Nair, HOD of Kerala University introduced us to this department. In medicinal garden we have seen the plants as follows.

No.	Botanical name	Family	Remarks
1	*Acacia chundra (Rottler) Wild.*	*Fabaceae*	Used in chemical products, medicinal and wood.
2	*Gmelina arboria Roxb.*	*Verbenaceae*	Fast growing tree, smooth whitish gray corky bark.

This day was the great day because we were going to visit a great place named TBGRI and also because this day was a last day of study.

1. TBGRI (**T**ropical **B**otanical **G**arden and **R**esearch **I***nstitute*): -

Introduction:-It is an autonomous Institute established by the Government of Kerala on 17th November 1979 at Trivandrum, the capital city of Kerala. It functions under the umbrella of the Science, Technology and Environment Department, Government of Kerala. The Royal

Botanic Gardens (RBG), Kew played an exemplary and significant role in shaping and design of garden lay out of TBGRI in its formative stages.

The Institute does research in Biotechnology and Taxonomy ,which are the two subjects considered to have immediate relevance to the development of the garden. While taxonomists prepared a flora of the garden documenting the native plant wealth before mass introduction and face lift which subsequently followed, the bio-technologists mass multiplied plants of commercial importance, especially orchids for cultivation and distribution to the public.

Functions: - TBGRI makes a comprehensive survey of the economic plant wealth of Kerala, to conserve, preserve and sustainably utilise the plant wealth. The institute carries out botanical, horticultural and chemical research for plant improvement and utilization; and offer facilities for the improvements of ornamental plants and to propagate them in the larger context of establishment of nursery and flower trade. The cultivation and culturing of plants of India/other countries with comparable climatic condition for the economic benefit of Kerala/India is also taken care. An activity to help botanical teaching and to create public understanding of the value of plant research is initiated by TBGRI. TBGRI gardens medicinal plants, ornamental plants and various introduced plants of economic or aesthetic value. TBGRI also serves as a source of supply of improved plants which are not readily available from other agencies It is basically a garden having a position in one of the top 80 gardens of world.

Introduction of garden:-

Garden is expended into 121acres huge area. It is divided in several compartments according to type of plants for e.g. orchidarium, bamboosettum, cactus house, arboretum and medicinal garden. Each and every corner of garden has its Owen value and meaningfulness. In the entrance right side of the garden on the small hill they have developed symbol of TBGRI by hedges, which gives an aesthetic appeal to the garden. On the opposite side the compartment has allotted to the family of ficus. The most interesting thing was each ficus tree has been grown in a pot in the form of bonsai. We were enthusiastic to see a climbing sp. of a ficus, A story of which our meme used to say. Our curiosity to see that climbing sp. of ficus was satisfied on that day. Botanical name of that sp. is *Ficus pumula*.

(1) Medicinal compartment:-

Dr. Panduranga introduced us with this garden;

This compartment is divided into small patches.These patches ware based on the name of ayurvedic medicines. E.g. dashmula is a name of ayurvedic medicine and that patch contains all the plants which are used for preparation of dashmulla. With that arboretum of medicinal plant was also there.

TABLE-14:- List of plant we have observed .

No.	Botanical name	Family	Remarks
1	*Oroxylum Indicum Vent.*	*Bignoniaceae*	The decoction of the bark is taken for curing gastric ulcer and a paste made of the bark powder is applied for mouth cancer, scabies and other skin diseases.
2	*Ailanthus excelsa Roxb.*	*Simaroubaceae*	it isused to treat diarrhea and dysentery, especially when there is a blood in stool. Alcoholic extract of the leaf and stem bark shows anti-implantation and early abortificient activity.
3	*Pterospermum suberifolium*	*Sterculiaceae*	For intense pain the traditional healers use the flowers of medicinal herbs Muchkand (Pterospermum suberifolium). The flowers are used internally both alone and in combination with other herbs.
4	*Adenanthera pavonia Linn*	*Mimosaceae*	This is a a small tree growing to a height of about 3 to 4 meters. In Ayurveda the fresh leaves are very useful in female diseases of uterus and menstruation. In old times the goldsmiths used seeds as weight, almost all the seeds have equal weight about 30 seeds in 11.5 grams
5	*Pongamia pinnata (L.) Pierre*	*Fabaceae*	. The bark yields a black gum that is used to treat wounds caused by poisonous fish. Although all parts of the plant are toxic and will induce nausea and vomiting if eaten,

			the fruits and sprouts.
6	*Couroupita guianensis Aubl.*	*Lecythidaceae*	pulp of the fruit of C. guianensis is used to feed animals .
7	*Mimusops elengi L.*	*Sapotaceae*	uses for treatment of asthma, diarrhea, fever, headache, rheumatism, sore eye and strengthening of gums.
8	*Elaeocarpus serratus L*	*Elaeocarpaceae*	Good for diarrhea due to its constipating effect.
9	*hemigraphis colorata (Blume) H.G.*	*Acanthaceae*	Murikoodi (Hemigraphis colorata) got its name from the fact that it is a quick healer of fresh cuts and wounds. Muri or murivu in Malayalam means a cut or wound and kooduka means to gather and here it refers to wound healing. Thus murikoodi can be translated into a wound-healer.

(2) Orchidarium:-

TABLE-15:- Species we observed in orchidarium.

No.	**Botanical name**	**Family**	**Remarks**
1	*Aranda Hilda Galistan*	*Orchidaceae*	It is a hybrid variety of {*Arachnis hookeriana* x *Vanda tricolor* cv. suavis)
2	*Grametophilum speciosum*	*Orchidaceae*	Because petal colour is like tiger skin this orchid is commonly known as tiger orchid. It is biggest among all the orchids. Its spike is 16-20 ft long and beers 100's of flower.
3.	*Peropex reticulata*	*Orchidaceae*	
4	*Aerida bogor*	*Orchidaceae*	
5	*Macadamia tetrifolium*	*Orchidaceae*	

6	*Canaga lorata*	*Orchidaceae*	
7	*Canarium strictum*	*Orchidaceae*	

(3) Bambosettum:-

Here **Mr. Gopakumar** introduced us with the bamboosettum. Here we were able to see the climbing bamboo. *Dinocloa andmanicus* which is the only climbing sp. of all bamboo and it is endemic to Andaman. The *Dendrocalamus giganticus* is the fastest growing bamboo in the world. We have also seen other sp. of bamboo like thorn bamboo, red bamboo etc, we also informed about the propagation of the bamboo. As bamboos may not flower for several decades the propagation of it mainly done by vegetative (i.e by suckers) and tissue culture method. Some interesting things about bamboo are as follows

- There are 1550 genera of bamboos in the world.
- Among these 23 genera and 123 Sp. Are present in India.
- Out of 123 Sp. 30 Sp. occur in south India alone. And in TBGRI 72 bamboo sp are grown.
- First largest existing Bamboo is grown at FRI Dehradun and TBGRI alone in India.
- They flowers in 3-120 yr.
- Two type of flowering patterns have seen in bamboo.
    - Gregarious flowering:- entire mass of bamboo flowers simultaneously.
    - Sporadic flowering:- only one plant among the patch would show flowering.

(4) Field Gene Bank:-

Dr. Abdul Jabbhar has introduced us with field gene bank. There are two main types of gene banks. i.e. in vitro (Cryopreservation) and in vivo (in field). Here we have seen different patches of *Costus*. The main difference along all is collected from the different regions according to habitat. By this we concluded that plants collected from rocky areas are more drought resistance then in rain forest.

During the whole trip we have seen more then 200 plant sp., more than 15 Pteridophytes, 5 Bryophytes, more then 25 Institutes and Parks and more then 10 plantations. We are very much thankful to Archana Mam and Solanki Sir for giving us such a nice experience.

Photos of the trip on the next page:

Chinese fishing net ↑

Eichhornia crassipes ↑

Central **M**arine **F**isheries **R**esearch **I**nstitute ↓

National **I**nstitute of **O**ceanography ↓

Electron microscope ↑

Seed separating machine (KFRI) ↑

Discussion with Dr. Chacko (KFRI) ↓

Handsome Fall: Athirapalli ↓

Tiger Orchid ↑

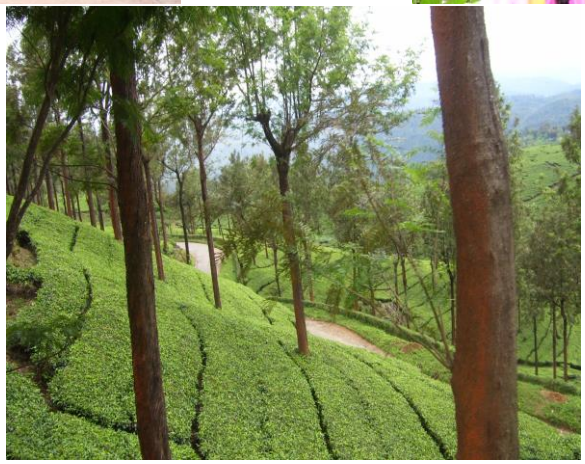
Piper nigrum ↑

Anthurium↑

Group photo with Dr. Z.Abraham(NBPGR)↓

Collection of Pteridophytes ↓

Pineapple Plantation↑



Tea Plantation↑

Elaichi Plantation↑

Rubber Plantation↓

Bay Leaf: Cinnamomum tamala (ICRI) ↓

Salvia-Blossom Park ↑

Cleome hassleriana

Discussion with Mr.Abraham↑

Hybrid Brinjal ↓

Group photo at CTCRI ↓

Fuchsia ↓