From the Editors' Desk…..

Biodiversity, which is defined as the variety and variability among living organisms and the ecological complexes in which they occur, is measured at three levels – the gene, the species, and the ecosystem. Forest is a key element of our terrestrial ecological systems. They comprise tree-dominated vegetative associations with an innate complexity, inherent diversity, and serve as a renewable resource base as well as habitat for a myriad of life forms. Forests render numerous goods and services, and maintain life-support systems so essential for life on earth. India in its geographical area includes 1.8% of forest area according to the Forest Survey of India (2000). The forests cover an actual area of 63.73 million ha (19.39%) and consist of 37.74 million ha of dense forests, 25.51 million ha of open forest and 0.487 million ha of mangroves, apart from 5.19 million ha of scrub and comprises 16 major forest groups (MoEF, 2002).

India has a rich and varied heritage of biodiversity covering ten biogeographical zones, the trans-Himalayan, the Himalayan, the Indian desert, the semi-arid zone(s), the Western Ghats, the Deccan Peninsula, the Gangetic Plain, North-East India, and the islands and coasts (Rodgers; Panwar and Mathur, 2000). India is rich at all levels of biodiversity and is one of the 12 megadiversity countries in the world. India's wide range of climatic and topographical features has resulted in a high level of ecosystem diversity encompassing forests, wetlands, grasslands, deserts, coastal and marine ecosystems, each with a unique assemblage of species (MoEF, 2002).

Surveys conducted so far in India have inventoried over 47,000 species of plants and over 89,000 species of animals over just 70% of the country's total area (MoEF, 1999). India's biogeographical location at the junction of the Agrotropical, Indo-Malayan and Paleo-Arctic realms has contributed to the biological richness of the country. The endemism of Indian biodiversity is high - about 33% of the country's recorded flora is endemic to the country and is concentrated mainly in the North-East, Western Ghats, North-West Himalaya and the Andaman and Nicobar islands. About 62% of the known amphibian species and 50% of the lizards are endemic to India, the majority occurring in the Western Ghats (MoEF, 1999). Genetic diversity comprising native species and land races is concentrated in the areas of the Western Ghats, Northern Himalayas, Southern plateau, Central India and Northwestern Himalayas.

The broad vision for biodiversity in Agenda 21 is its conservation and sustainable use accompanied by equitable benefit sharing mechanism. This includes a focus on enhancing national biodiversity protection measures involving the development of national strategies; mainstreaming of biodiversity concerns; ensuring the fair and equitable sharing of the benefits accruing from biodiversity; country-wide studies on biodiversity; fostering traditional methods and indigenous knowledge; encouraging biotechnological innovations along with the suitable sharing of their ben-

efits and promoting regional and international cooperation.

The MoEF is also the focal point for implementation of the Convention on Biological Diversity. The mandates of the Ministry inter-alian include survey of flora, fauna, forests and wildlife, and conservation of natural resources. The Biodiversity Bill is an important mechanism for regulating access to biological resources and in establishing benefit-sharing arrangements. The legislation primarily addresses the issue concerning access to genetic resources and associated knowledge by individuals, institutions or companies, and equitable sharing of benefits arising out of the use of these resources and knowledge to the country and the people. The legislation provides for setting up of a three-tiered structure at national, state and local level.

A major advancement for the cause of biodiversity conservation in the country and in compliance with requirement of the Convention on Biological Diversity is the drafting of the country's National Biodiversity Strategy and Action Plan (NBSAP) with funding support from GEF, the Global Environmental Facility. The strategy and action plan are very broad in scope and comprehensive in coverage and propose to prepare detailed action plans at sub-state, state, regional and national levels based on the framework Policy and Action Strategy on Biodiversity. NBSAP is India's biggest planning and development process aiming at conservation and sustainable use of biological diversity. India has enacted an umbrella legislation called the Biodiversity Act, 2002 (No 18 of 2003) and also notified the Biological Diversity Rules, 2004. The Act and Rules, no doubt, will be helpful to the implementers and to those seeking access to bio-resources.

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BIOLOGICAL DIVERSITY ACT - 2002

Prof S.Kannaiyan

Chairman, National Biodiversity Authority, Chennai – 600 041.

Introduction:

Biodiversity encompasses the variety of all life on earth. India is one of the 17-mega diverse countries of the world. With only 2.5% of the land area, India already accounts for 7.8% of the global recorded species. India is also rich in traditional and indigenous knowledge, both coded and informal.

India is a Party to the Convention on Biological Diversity (CBD) (1992). Recognizing the sovereign rights of States to use their own biological resources, the Convention expects the Parties to facilitate access to genetic resources by other Parties subject to national legislation and on mutually agreed upon terms (Article 3 and 15 of CBD). Article 8(j) of the Convention on Biological Diversity recognizes contributions of local and indigenous communities to the conservation and sustainable utilization of biological resources through traditional knowledge, practices and innovations and provides for equitable sharing of benefits with such people arising from the utilization of their knowledge, practices and innovations.

Biodiversity is a multi-disciplinary subject involving diverse activities and actions. The stakeholders in biological diversity include the Central Government, State Governments, institutions of local self-governmental organizations, industry, etc. One of the major challenges before India lies in adopting an instrument, which helps to realise the objectives of equitable sharing of benefits enshrined in the Convention on Biological Diversity.

Salient Features of the Biological Diversity Act - 2002:

- After an extensive and intensive consultation process involving the stakeholders, the Govt. of India has brought Biological Diversity Act, 2002.
- To regulate access to biological resources of the country equitable share in benefits arising out of the use of biological resources.
- To conserve and sustainable use of biological diversity.
- Setting up of National Biodiversity Authority (NBA), State Biodiversity Board (SBB) and Biodiversity Management Committee's. (BMC's).
- NBA and SBB are required to consult BMCs in decisions relating to bioresource / related knowledge within their Jurisdiction.
- To respect and protect knowledge of local communities traditional knowledge related to biodiversity.
- To secure sharing of benefits with local people as conservers of biological resources and holders of knowledge and information relating to the use of biological resources.
- All foreign nationals / organizations require prior approval of NBA for obtaining biological resources and / or associated knowledge for use.
- Indian scientists / individuals require approval of NBA for transferring results of research to foreign nationals / organizations.
- Conservation and development of areas of importance from the standpoint of biological diversity by declaring them as biological diversity heritage sites.
- Protection and rehabilitation of threatened species.
- Involvement of institutions of State Government in the broad scheme of the implementation of the Biological Diversity Act through constitution of committees.
- Protect India's rich biodiversity and associated knowledge against their use by foreign individuals and organizations without sharing benefits arising out of such use and check Biopiracy.
- Indian Industry needs prior intimation to SBB to obtain bioresource. SBB has right to restrict if found to violate conservation and sustainable use and benefit sharing.
- Provisions for notifying heritage sites by State Government in consultation with local body.
- Creation of National, State and Local Biodiversity Fund and its use for conservation of biodiversity.
- Prior approval is needed from NBA for IPRs in any invention in India or outside India on Bioresource

Biodiversity:

Biological Diversity means the variability among living organisms from all sources, including interalia, terrestrial, marine and other aquatic ecosystems and the ecological complexes of which they are part and this includes diversity within species, between species and of ecosystems. Biodiversity is defined as the variety and variability among living organisms and the ecological complexes in which they occur is measured at three levels viz., genes, species and ecosystem.

Convention on Biological Diversity:

The Convention on Biological Diversity (CBD) is a landmark in the environment and development field, as it takes for the first time a comprehensive rather than a sectoral approach to the conservation of Earth's biodiversity and sustainable use of biological resources. It was in the year 1984 that the needs to have in place a global convention on biological diversity started gaining momentum. In response, the United Nations Environment Programme (UNEP) in the year (1987) recognized the need to streamline international efforts to protect biodiversity. It therefore established an ad hoc working group to investigate "the desirability and possible form of an umbrella convention to rationalize current activities in the field. This group by 1988 concluded that a) the existing treaties were inadequate to address the issue of conservation and sustainable use and b) a new global treaty on biological diversity was urgently needed. Organisations such as the World Conservation Union (IUCN) and the Food and Agricultural Organisation (FAO) contributed draft articles in addition to specific studies commissioned by the UNEP. The UNEP Secretariat prepared the first draft and the formal negotiating process was started in 1991. The Inter-governmental Negotiating Committee for a Convention on Biological Diversity (INC) was given the task of ensuring the adoption of the Convention. On May 22, 1992 the nations of the world adopted the CBD in Nairobi and on June 5, 1992 the CBD was tabled at the UN Conference on Environment and Development in Rio de Janeiro where a record 150 countries signed the Convention.

The Convention on Biological Diversity (CBD) was negotiated and signed by nations at the UNCED Earth Summit at Rio de Janeiro in Brazil in June 1992. The Convention came into force on December 29, 1993. India became a Party to the Convention in 1994. At present, there are 175 Parties to this Convention.

The main objectives of the Convention are:

- Conservation of biological diversity;
- Sustainable use of the components of biodiversity;
- Fair and equitable sharing of benefits arising out of the utilisation of genetic resources.

Re-affirming the sovereign rights of Parties over their own biodiversity, the Convention balances conservation with sustainable utilisation and access to and use of biological resources and associated knowledge with equitable sharing of benefits arising out of such use. The CBD offers opportunities to India to realise benefits from its rich biological resources and associated traditional knowledge.

The CBD stipulates that the parties, even though having sovereign rights over their biological resources, would facilitate access to the genetic resources by other parties subject to national legislation and on mutually agreed terms. The CBD also provides for equitable sharing of benefits arising from the utilisation of traditional knowledge and practices, with holders of such knowledge. This has made it necessary for a legislation to be put in place, which lays down the framework for providing access, for determining the term of such access and for ensuring the equitable sharing of benefits.

Summary of Biological Diversity Act, 2002:

- 12 Chapters
- 65 Sections and many subsections
- Notified Notifications and Rules
- Chapter – I : Preliminary – Terminologies
- Chapter – II : Regulations of access to Biological Diversity
- Chapter – III : National Biodiversity Authority
- Chapter – IV : Functions and Powers of National Biodiversity Authority
- Chapter – V : Approval by the National Biodiversity Authority
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- Chapter – IX : Duties of the Central and State Governments
- Chapter – X : Biodiversity Management Committees
- Chapter – XI : Local Biodiversity Fund
- Chapter – XII : Miscellaneous

Management structure of Biodiversity Act:

A three tiered structure at the national, state and local level is envisaged.

National Biodiversity Authority (NBA):

All matters relating to requests for access by foreign individuals, institutions or companies, and all matters relating to transfer of results of research to any foreigner will be dealt with by the National Biodiversity Authority.

State Biodiversity Boards (SBB):

All matters relating to access by Indians for commercial purposes will be under the purview of the State

Biodiversity Boards (SBB). The Indian industry will be required to provide prior intimation to the concerned SBB about the use of biological resource. The State Board will have the power to restrict any such activity, which violates the objectives of conservation, sustainable use and equitable sharing of benefits.

Biodiversity Management Committess (BMCs) :

Institutions of local state government will be required to set up biodiversity management Committees in their respective areas for conservation, sustainable use, documentation of biodiversity and chronicling of knowledge relating to biodiversity.

NBA and SBBs are required to consult the concerned BMCs on matters related to use of biological resources and associated knowledge within their jurisdiction.

People's Biodiversity Register (PBR):

- Many of our local people or ecosystem people possess valuable knowledge of uses of biodiversity such as herbal remedies and vegetable dyes, much of the knowledge of the status and dynamics of biodiversity also resides with the people at grassroots
- The tremendous valuation from place to place in the distribution and uses of biodiversity, the documentation has to be highly location specific and time specific
- The PBR is a complex process involving a series of activities linked to each other in many different ways.

National Biodiversity Authority (NBA) :

- Establishment of NBA.
- The head office of the NBA is established at Chennai.
- NBA consists of the following members.

Members of NBA:

- A Chairperson who shall be an eminent person having adequate knowledge on conservation and sustainable use of biological diversity.
- Three ex-officio members appointed by the Central Government. One representing the Ministry dealing with Tribal affairs.Two representing the Ministry dealing with Environment and Forests of whom one shall be the Additional Director General of Forests.
- Seven ex-officio members appointed by the Central Government to represent respectively the Ministries of the Central Government dealing with
    - Agricultural Research and Education
    - Biotechnology
    - Ocean Development
    - Agriculture and Cooperation
    - Indian Systems of Medicine and Homeopathy
    - Science and Technology
    - Scientific and Industrial Research
- Five non-official members appointed amongst specialists and scientists, representatives of industry, conservers, creators and knowledge holders of biological resources

Functions and Powers of NBA:

- Regulate activities, approve and advice the government of India on research, commercial, bio-survey and bio-utilization.
- Grant approval to Section 3,4 and 6.
- Certain persons not to undertake Biodiversity related activities without approval of National Biodiversity Authority (Section 3).
- Results of research not to be transferred to certain persons without approval of National Biodiversity Authority (Section 4).
- Application for IPR rights not to be made without approval of National Biodiversity Authority (Section 6).
- Perform such other functions as may be necessary to carry out the provisions of this act.

Approvals by NBA:

- Any person who intends to access or apply for a patent or any other form of IPR protection whether in India or outside India referred to sub-section (1) of Section 6 may make an application prescribed by NBA.
- Any person who intends to transfer any biological resource or knowledge associated thereto referred to sub-section (1) of Section 3 shall make an application in such form and in such manner as may be prescribed to the National Biodiversity Authority.
- Determination of equitable benefit sharing by National Biodiversity Authority.

State Biodiversity Board (SBB):

- Establishment of State Biodiversity Board in every State.
- State Government may by notification in the Gazette can establish the SBB in their State name e.g Tamil Nadu Biodiversity Board.
- No State Biodiversity Board shall be constituted for a Union Territory and in relation to Union Territory, the National Biodiversity Authority shall exercise the powers and perform the functions of a SBB for the Union territory.

Collaborative Research:

Collaborative research projects involving transfer or exchange of biological resources between government sponsored institutions and similar institutions in other countries will be exempted from this regulation.

Intellectual Property Rights:

Intellectual Property Rights relating to biological resources must be defined in order to ensure that the benefits derived from their use are equitably shared. Section 6 of the Act underlines this principle. In case of persons intending to apply for any form of Intellectual Property Right in or outside India for any invention based on any research or information on a biological resource found in India, prior permission of the NBA is required. The NBA may impose benefit sharing fee or royalty or conditions on the financial benefits arising out of commercial utilization of such right while granting permission. Section 21 provides for the determination of "equitable benefit sharing" which is also one of the objectives of the Act. NBA in consultation with local bodies can impose terms and conditions for securing equitable sharing of benefits.

National Biodiversity Fund:

A National Biodiversity Fund is being constituted for this purpose. The NBA will ensure that equitable benefit sharing is made during the utilization of biological resources and the knowledge relating to them. The amount of benefit sharing will be deposited in the National Biodiversity Fund and the amount shall be paid directly to such individuals or groups of individuals or organizations in accordance with the terms of any agreement in such manner as decided by the NBA. On behalf of the Central government, the NBA will take all measures to oppose Intellectual Property Rights granted outside India on any biological resource or associated knowledge originating from India.

Enforcement:

The section dealt with under chapter XII provides for enforcement in general and deals with penalty, cognizance of offences, offences by companies, appeal etc in particular. Section 58 provides that the offences under the Act shall be cognizable and non-bailable.

Any person, aggrieved by any determination of benefit sharing or order of the Authority under this Act may file an appeal to the High Court. The time allowed to prefer an appeal is 30 days from the date of communication to the aggrieved person of the Order of the Authority.

If any person contravenes any direction given or order made by the Central Government, the State Government, the National Biodiversity Authority or the State Biodiversity Board for which no punishment has been separately provided under the Act the person shall be punished with a fine which may extend to one lakh rupees and in case of a subsequent offence the fine may extend to two lakh rupees and in case of continuous contravention with additional fine which may extend to two lakh rupees everyday which the default continues.

Biopiracy:

To check biopiracy, the proposed legislation provides that access to biological resources and associated knowledge is subject to terms and conditions, which secure equitable sharing of benefits. Further, it would be required to obtain the approval of the National Biodiversity Authority before seeking and IPR based on biological material and associated knowledge obtained from India.

Exemptions provided in the Act:

The Biological Act, 2002 provides for the following exemptions:

- Exemption to local people and community of the area for free access to use biological resources within India.
- Exemption to growers and cultivators of biodiversity and to Vaids and Hakims to use biological resources.
- Exemption through notification of normally traded commodities from the purview of the Act.
- Exemption for collaborative research through government sponsored or government approved institutions subject to overall policy guidelines and approval of the Central Government.

TECHNICAL SESSION - I

FLORISTIC ANALYSIS AND BIODIVERSITY

TI–01 BIODIVERSITY AND CONSERVATION WITH SPECIAL REFERENCE TO EASTERN GHATS

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The Eastern Ghats are 'Tors' of geological antiquity with isolated mountain ranges lying between Mahanadi and Vaigai rivers of Peninsular India. The area is spread over a length of about 1750 km near the Coromandel Coast between 10º - 20º N latitudes with varied precipitation under monsoon conditions. Floristically the region is rich with ca 2000 species of flowering plants which constitute 13% of the Indian Flora. Very little attention was paid to the biogeographical studies in this area.

The vegetation of Eastern Ghats ranges from moist deciduous type in the north to dry deciduous type in the south. These forests are composed of tropical, subtropical and temperate elements along with evergreen types which occur at high elevations. Its characteristic elements are *Hardwickia binata, Pterocarpus santalinus, Santalum album, Shorea robusta, Shorea tumbaggaia, Terminalia pallida* and *Syzygium alternifolium*. This diversity and heterogeneity of plant life naturally manifest with a high degree of genetic potential which can be tapped for the improvement of cultivars through genetic engineering of their wild relatives.

The plant genetic resources of Eastern Ghats find wide ranging applications. Many of the less known plants can be used by way of food, forage, medicine and timber. Some of these strictly endemic to Eastern Ghats. Conservation and prudent management of the limited genetic stocks like *Atylosia cajanifolia, Caralluma indica, Cycas beddomei, Luffa acutangula* var. *amara, Musa balbisiana, Oryza jeyporensis, O.officinalis* ssp. *malampuzhaensis, Pterocarpus santalinus, Shorea tumbaggaia* etc., is urgently needed.

The endemic and endangered plants of Eastern Ghats include: *Andrographis beddomei, A. nallamalayana, Barleria morrisiana, Dicliptera beddomei, Justicia gingiana, Neuracanthus neesianus, Nilgirianthus circarensis, Phlebophyllum jeyporense, Rostellularia vahlii* var. *rupicola, Santapua madurensis, Alphonsea maderaspatana, Uvaria uncinata, Bupleurum andhricum, Pimpinella tirupatensis, Brachystelma glabrum, B. volubile, Caralluma indica, C. lasiantha, Toxocarpus roxburghii, Notonia shevaroyensis, Vernonia shevaroyensis, Cordia domestica, C. evolutior, Boswellia ovaliofoliolata, Maytenus bailadillana, Argyreia arakuensis, Kalanchoe cherukondensis, Shorea tumbaggaia, Euphorbia linearifolia* var. *nallamalayana, E. senguptae, Croton scabiosus, Lasiococcus comberi, Phyllanthus narayanaswami, Tragia gagei, Cajanus cajanifolius, Crotalaria sandoorensis, C. shevaroyensis, Indigofera barberi, Pterocarpus santalinus, Rhynchosia beddomei, Sophora interrupta, Tephrosia roxburghiana, Leucas diffusa, L. lavandulifolia* var. *nagalapuramiana, L. flaccida* var. *sebastiana, L. mukherjiana, L. nepetifolia, Actinodaphne maderaspatana, Urginea nagarjunae, Decaschistia cuddapahensis, D. rufa, Memecylon madgolense, Albizzia orissensis, Habenaria panigrahiana, H. ramayyana, Arundinella setosa* var. *lanifera, Chrysopogon velutinus, Dimeria orissae, Oryza jeyporensis, Themeda mooneyi, T. saccicola, Lasianthus truncatus, Pavetta madrassica, Wendlandia gamblei,*

Triphasia reticulata var. *parviflora*, *Eriolaena lushingtonii* and *Premna hamiltonii*. Most of the endemic taxa of Eastern Ghats are paleoendemics and survival of some rare ones which have narrow distributional range and adapted to specialized conditions, is dependent on the biotic, edaphic and climatic factors, genetic structure in totality and past history of their populations. The Eastern Ghats have some 'ecological islands' that harbour endemic plants (Nayar, 1996). These areas are Ganjam – Koraput range in Orissa, Visakhapatnam hills (including Araku valley and Madgol hills), Nallamalai – Cuddapah range and Tirupati hills of Andhra Pradesh, Shevaroys of Tamil Nadu. Most of these areas are under commercial exploitation of land by way of quarrying and mining (Koraput, Araku, Gudem, Papi hills, Kolli hills), dam construction (Nagarjunasagar, Polavaram and Srisailam), monoculture and forest plantations (Koraput, Jeypore, Gudem, Tirupati, Shevaroy) and hydroelectric projects (Machkund, Sileru) and thermal power projects (Kondapalli). These factors had a devastating effect on the vegetation and natural habitats of the region.

The conservation of biodiversity is not only important for preservation by way of a gene bank but also for the protection of existing forests from further degradation caused by all factors. The foresmost attempt in the conservation strategies should be avoidance of indiscriminate forest felling and forest fire, collection and preservation methods of seed output and germination of rare and endangered species. Wild life is an integral part of forests. Their existence is also necessary for ecological or environmental balance. There are 12 wildlife sancturies in Eastern Ghats, three in Orissa, seven in Andhra Pradesh and two in Tamil Nadu. It is therefore considered very important to conserve existing biodiversity in terms of increasing and protecting natural population and density.

*****

TI–02 STATUS OF PLANT DIVERSITY IN LABRANG VALLEY OF COLD DESERT IN DISTRICT KINNAUR, HIMACHAL PRADESH

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Himalayas are one of the largest and youngest mountain chains in the world and cover roughly 10% of India total land surface. Variations in terms of its size, climate and altitudinal ranges have created environments those are unique and characteristic to this region only. The diverse climate and the varied environmental conditions prevailing in Himalayas support diverse habitat and ecosystems with equally diverse life forms. The cold deserts in India occur in Ladakh region of Jammu & Kashmir, Spiti valley of Lahaul and Spiti district and Pooh sub division of Kinnaur district of Himachal Pradesh. The total area under cold deserts in Himachal Pradesh is about 11,000 sq.km., out of which 3,400 sq.km. area is in Kinnaur district. In cold desert areas, continuous removal of plant species for various uses and overgrazing by migratory livestock have resulted in desertification and loss of biodiversity. The assessment of plant wealth in this harsh cold arid belt may provide a key for its

conservation. Keeping these aspects in view, a study was conducted to know the plant diversity along an altitudinal gradient in Labrang valley of cold desert area of Pooh sub division of district Kinnaur, Himachal Pradesh during, 2004 at an elevation of 3000 m to 5000m. The study site was situated 31°40'46.8" to 31°42'37.5" N latitude and 78° 26' 32.2" to 78°28'30.5" E longitudes. The whole area of the valley was divided into four altitudes i.e. 3000-3500 m, 3500-4000m, 4000-4500m and 4500-5000 m for conducting the phyto-sociological study. Quadrats of size 10x10m, 3x3m amd 1x1m laid out randomly for enumerating trees, shrubs and herbs + regeneration respectively. The vegetation data was analysed for density, frequency, abundance, importance value index, distribution pattern, dominance and diversity index. The number of tree species at 3000-3500m elevation was 11 with the dominance of *Cedrus deodara*. The number of shrub species was 21, 16 and 8 in the elevation of 3000-3500m, 3500-4000m and 4000-4500m respectively. *Caragana brevispina* was the dominant shrub at 3000-3500m elevation whereas *Juniperus indica* was the dominant shrub at 3500-4000 and 4000-4500m elevation range. The number of herb species was 83, 82, 38 and 25 at 3000-3500m, 3500-4000m, 4000-4500m and 4500-5000m elevation ranges respectively. On the basis of importance value index (IVI), *Artemisia brevifolia, Arenaria festucoides*, *Arenaria serpyllifolia* and *Thylacospermum caspitosum* was the dominant herb at 3000-3500m, 3500-4000m, 4000-4500m and 4500-5000m elevation ranges respectively. The distribution pattern of plant species was mostly contiguous in all the altitudes ranges. Index of diversity for herb species was 5.565, 5.726, 4.358 and 3.595 for 3000-3500m, 3500-4000m, 4000-4500m and 4500-5000m elevation ranges respectively. The index of similarity for shrub and herb species between different altitudes was low. This indicate remarkable degree of dissimilarity in plant species between different altitudes. Out of 75 medicinal plant species recorded from the area, 16 species i.e. *Aconitum heterophyllum, Bergenia stracheyi, Betula utilis, Corydalis govaniana, Dactylorhiza hatagirea, Heracleum candicans, Hyoscyamus niger, Hyssopus officinalis, Juniperus communis, Juniperus macropoda, Lactuca macrorhiza, Pleurospermum brunonis, Rheum webbianum, Rhodiola heterodonta, Selinum tenuifolium* and *Thymus linearis* fall in the category of threatened plants. The habitat of most of the plant species have shrunk due to expansion of human population and environmental degradation primarily due to heavy live stock grazing, uncontrolled and unscientific harvest of species, unregulated tourism and construction of roads etc. The better conservation of natural resources can be done by inclusion of a section on the plant conservation especially of rare and endangered medicinal plants in the wild life protection act, promotion of community based conservation, *in-situ* conservation through the establishment of nature reserves, *ex-situ* conservation through tissue culture, developing cultivation technologies and nurseries of medicinal plants and conducting of regular training on the procedure of medicinal plants collection, processing among the local people, traders and real stake holders.

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TI–03 ALTITUDINAL FLUXES OF SIMILIPAL BIODIVERSITY

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In this study we examined the patterns of soil physico-chemical characteristics, phytodiversity, growth forms and phonological behaviour of plants at different altitudes (100m – 900m) of Similipal Biosphere Reserve (SBR) and compared with values from other similar forests. The low elevation appears to be drier than higher elevation. In the present investigation a total of 305 plant species were recorded, of which 105 were trees, 63 shrubs, 17 climbers and 120 herbs. The deciduous trees were maximum at lower elevations and evergreen trees were maximum at higher elevations. The total number of trees, shrubs, herbs and climbers were varied according to the change in elevation. The correlation study between elevation and different growth forms of the plants signify that trees and herbs are negatively correlated with elevation. Likewise in soil, soil moisture, pH, nitrate-nitrogen, phosphate and organic carbon are positively correlated with elevation while potassium is negatively correlated with elevation. Like that of plant growth forms and soils, the vegetative and reproductive phenology of trees (overstorey species) and shrubs (understorey species) were also changed according to the change in elevation and climate. From the present investigation it was also revealed that the number of deciduous species was relatively more than the evergreen and semievergreen species irrespective of the plant growth forms i.e. trees, shrubs and climbers, which may be due to spatial fluctuation in climatic conditions. The study concludes that the distribution, phenology and species richness pattern of different plant growth forms in this region largely depends on the altitude and variation in climatic variables.

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TI–04 DIVERSITY OF CLIMBERS AND LIANAS OF NORTH ANDAMAN

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Climbers are plants that rely on other plants for support. Lianas (woody climbers) and vines (herbaceous climbers) represent a very conspicuous and dominant growth form in tropical forests. However, in most of the floras or forest inventories lianas are either ignored or not adequately indicated. The overall low attention to lianas is most probably due to their low-microeconomic importance.

In general, ecological information on climbers and lianas is scarce. No adequate data of climbers and lianas regarding their census, bio-morphology, richness, frequency, abundance and spatial and regional distribution pattern or socio-economic aspect of the Andaman Islands are available.

The present paper deals with the climbers and lianas of N. Andaman as to their taxonomic survey, abundance (density/frequency etc) and rarity, morphological adaptations for climbing, spatial association and distribution, dispersal syndromes and the threats operating to stress for their protection and conservation.

North Andaman is mostly covered with tropical evergreen, semi evergreen, moist deciduous, littoral and mangrove forests. Sometimes, different forest types in inland forests are very difficult to be distinguished because of intermingling or overlapping of species. Without exception most of them are mixed type and due to past extraction secondary forests of re-growth occupy most of them. The forest cover is 92.2% of the total land area of which only 86.93% has been surveyed till now (FSI, 1999).

The present study could record 149 herbaceous climbers and 79 lianas from all the forests types of North Andaman, covering 55 families. In dicotyledons, there are 44 families containing 111 genera and 199 species. The dominant families are Fabaceae, Convolvulaceae, Asclepidaceae, Vitaceae, and Menispermiaceae.

In the monocotyledons, there are 8 families which contain 22 species of climber and lianas, the main dominant families are Araceae and Smilacaceae. *Gnetum scandens* of Gnetaceae is the only liana in the gymnosperms. There are only 3 species under 2 genera belonging to 2 families under the Pteridophyte.

Out of the 228 species of climbers and lianas, there are 33 tendril climbers, 62 twiners, 15 root climbers and 28 hook climbers; the others being shoot/ branch climbers and sprawlers.Members of the families Fabaceae, Vitaceae, Apocynaceae are mainly lianas. Members of the families like Asclepiadaceae, Cucurbitaceae, Liliaceae, Passifloraceae, Menispermaceae, and Piperaceae etc. were found mostly as herbaceous climbers.5 species of *Calamus* are common in this area and these depend more on the spatial arrangement of supports than on the diameter of any part of their trellis. Leaves or modified inflorescences bearing grapnel-like spines extend several meters out form the rattan stems and hook into almost anything they encounter. In semi-evergreen forests, climber and lianas are predominant and the dominant lianas are Calamus palustris, C.andamanicus, C. viminalis, Entada phaseoloides, Gnetum scandens, Daemonorips manii, Combretum decundrum, Paramignya armata. In moist deciduous forests, the most dominant climbers and lianas are *Buttneria andamensis, Cissus hastate, Atrabotrys specious, Vigna marina, Harrisonia brownii, Thunbergia laurifolia.* The most dominant climbers and lianas in the littoral forests are *Caesalpinia crista, Mukuna gigantia, Derris scandens, Colubrina asiatica, Sarcolobus carinatus, Ipomoea pes-caprae,Hoya parasitica* and *Dischidia bengalensis.*

Climbers and lianas are more prolific at the edges of the forests and in gaps. Most of the branch and tendril climbers are sun loving while the hook and root climbers stay in shade. Twiners appear ubiquitous.

Importance Value Indices of the dominant species of climbers and lianas ranged form 1.40081 to 20.4172.

It has been found that fruit is the dispersal unit of more than 60% species of climbers and lianas, and zoochory is abundant (65.2%) than anemochore (22.9%).

The number of species of climbers and lianas reported from N. Andaman only represents 14.27 % of the total flora recorded from Andaman and Nicobar group of Islands and fits well within the general pattern of

8-12% composition of this group in tropical forest floras.

Climbers and lianas are very unevenly distributed in different forest types. There are more then 20 common species, which are present in more then one-forest type. It has been observed that forests with closed canopies and which are wet or moist are rich in lianas. Herbaceous climbers in contrast are more prevalent in drier sites and in forest gaps.

Due to anthropogenic activities the evergreen forests are gradually decreasing so also the typical liana species in them. How ever, climbers and lianas are capable of growing frequently wherever there is a gap and their frequency can be taken as an indicator of past clearings as also for the nature of secondary forests.

The threats are shrinkages or conversions of forest areas, vine clearing as forestry practice, exploitation and lack of awareness of the importance of vines. Regeneration of canes needs to be promoted specially because of their wide economic value.

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TI–05 ANGIOSPERM DIVERSITY IN RIPARIAN ZONES OF SOME BASIN WETLANDS IN ARUNACHAL PRADESH

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Wetlands which cover about the 6% of earth surface are complex hydrological and biogeochemical systems characteristically transitory between aquatic and terrestrial ecosystems. They are well known for high biological diversity and socioeconomic functions. The present paper documents the preliminary attempt in aiming at the enumeration of angiosperm diversity in Papum Pare district of Arunachal Pradesh in the northeast India. Five basin wetlands have been selected for the present study, all of them are natural. A survey of angiospermic plant diversity has yielded 85 species so far; out of which there were 48 dicots and the remaining 37 species were monocots. Among the dicots *Polygonum hydropiperoides, Ipomea aquatica, Ludwigia perennis, Ageratum conyzoides, Mikania micrantha, Eupatorium perfoliatum* and *Spilanthes paniculata* are quite common, whereas *Amaranthus albus Achyranthes aspera, Aeschynomene indica, Polygonum chinnensis, Eclipta alba* and *Polygonum barbatum* were rare. Among the monocots, *Eichornia crassipes,* various species of *Lemna, Cyperus, Pistia strtoides, Salvinia* Spp. and *Phragmites australis* were most common while *Eleocharis* Spp., *Typha angustifolia, Commelina diffusa* and *Juncus biflorus* were rare. In the present work, the socio-economic potential aspects of these wetland species are being recorded on the basis of their ethnic utilization patterns.

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TI–06 FLORISTIC STUDIES WITH SPECIAL REFERENCE TO MEDICINAL PLANT DIVERSITY AND CONSERVATION OF SIRUMALAI HILLS OF EASTERN GHATS, SOUTH INDIA

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Sirumalai hills is located in the Eastern Ghats with four distinct forest types, viz. scrub forest, deciduous forest, savannah woodland and semi-evergreen forest. The hills harbour about 1,100 species of higher plants. About 60 endemic plants of South India are represented in the vegetation of these area and several of them are rare and endangered, specifically *Lobelia nicotianifolia*, *Myristica tactyloides* and *Entada pursaetha*. More than 100 common medicinal plants were enumerated from the study area. The isolated native tribal community namely Paliyans, who are an ancient inhabitants of the hills and they are still following traditional nomadic life. Ethnomedicobotanical exploration among the Paliyans of Sirumalai hills yielded 110 plant species used in 115 formularies against more than 20 ailments. Leaves are used in high proportion (34.3%) when compared to other parts of the medicinal plants. The medicinal formulations are administered orally (74.8%), externally (24.7%) and inhaled (0.5%) by the Paliyans. Sirumalai hills have a rich diversity of vegetation with much local heritage. But the impact of recent anthropogenic pressure and forest encroachment activities on the vegetation was intense. But still several areas in this hill conserved by local beliefs and faith retain relictual vegetation. Due to intense deforestation activities and discontinuity of traditional knowledge and medicinal plants in their original habitat are urgent tasks to be taken up for conserving the plants for posterity.

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TI–07 ECOLOGICAL STUDIES ON HERBACEOUS VEGETATION IN TWO DRY DECIDUOUS FORESTS IN DINDIGUL DISTRICT OF TAMILNADU

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Structure and functional attributes of herbaceous community in two dry deciduous forests were analyzed. Greater species diversity was recorded in the Alagar hills when compared to Karanthamalai. This may be due to low levels of disturbance in Alagar hills when compared to Karanthamalai. Higher shoot length of *L.camara* in closed canopy may be attributed to light limited environment created by the nature habitat here. Maximum seed output of exotics in open canopy due to favorable microclimatic conditions and exploitative strategy of this species. Plasticity in biomass allocation pattern showed ruderal behavior and *Lantana camara* and *Chromolaena odorata*. Greater aboveground biomass and productivity in the Karanthamalai may be due to successful establishment of exotics in this site. The intentional and unintentional disturbances in the dry deciduous forests resulted in exotic plant invasions. The successful invasions altered the structure and function of herbaceous

community. Therefore it is essential to give immediate attention in order to avoid further shrinkage grasslands and loss of local biodiversity. The possible exotics plant biomass utilization is one of the viable option to reduce the menace of exotic weeds.

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TI–08 PLANT DIVERSITY AND ECOLOGY OF RIVER VARAHI BASIN AND ITS ENVIRONS- HOSANGADI, UDUPI, KARNATAKA

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The study area covers about 10km^2, which supports semi-evergreen to dry deciduous types of forest. It has been undertaken to carryout scientific survey on aquatic and terrestrial flora, with special emphasis to indigenous, rare, endangered species and phytosociological studies.

The river Varahi is west flowing river originating from the high peaks of the Western Ghat, a place called Hebbagilu near Guddekoppa village in the Hosanagar taluk of Shimoga district at an elevation of 761 m MSL . It flows in Shimoga and Udupi and travelling a distance of 88 Km, and join Arabian Sea near Kundapur in Udupi district. The river Varahi has been one of the major sources of water for Mani Pickup Dam & Fore Bay Dam for generating electricity. The major type of soil is red lateritic, climate is moderately hot & humid. The maximum & minimum temperature is 38 ^oC & 24 ^oC respectively; heavy rains receive during June – August. The average rainfall is 458 cm. Altitude of the study area is range from 80m MSL form Hosangudi towards Siddapur to highest peak is about 750m MSL where Mani Hydro Electrical Dam was built.

The phytosociological data from 22 sampling plots, highest frequency is seen in *Aporosa lindleyana* (Wt.) Baill & *Macaranga peltata* M Arg. [72] lowest in *Annona reticulata* L. *Atlantia wightii* Tanaka, *Ehretia canarensis* Mig. [4.5] etc. Similarly abundance is highest in *Tectona grandis* L. [18.00] & lowest in *Aegle marmelos* Carr, *Albizzia odoratissima* (L.f) Banth , *Annona reticulata* L. [1.0], etc. Where as density is highest in *Xylia xylocarpa* Taub. [4.36] and lowest in *Albizzia odoratissima* (L. f.) Benth, *Artocarpus hirsuts* [0.09] etc. In case of Importance Value Index [IVI] maximum value is seen in *Aporasa lindleyana* (Wt.) Baill & lowest in *Bauhinia racemosa* L. About 275 species from angiospermic group were consider for the RET status, out of which, 29 rare, 24 endemic, 03 endangered and 02 threatened species were noticed. Most interestingly about 105 species are medicinally important.

All along the river 50 species were recorded, of which, 02 are rare species, 03 endemic species, 01 endangered species and 08 species are medicinally value.

TI–09 BIODIVERSITY CHARACTERIZATION AT LANDSCAPE LEVEL

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With the advent of various remote-sensing sensors of better resolution and spectral range and spatial analysis tools like GIS, the spatial distribution and analysis of vegetation types have been possible with greater accuracy as well as saving time and money. The maintenance of biodiversity in a landscape depends on extrinsic and intrinsic factors regulating the ecosystem functioning. In most of the tropical forests the major threat to the forest is not outright deforestation. Rather the forests and their biota are suffering from simplification – due to selective harvesting of certain species (Noss and Cooperridae, 1994), and fragmentation, where the remaining tracts of native forests are separated due to the anthropogenic activities.

It is a well-known fact that ecological systems do not exist as discrete units but are different parts of natural continuum of the environmental gradient consisting of different land-cover patches. So it is imperative that the biological diversity also changes along the ecological gradient. Biodiversity has been expressed at different levels - genetic, species and landscape level. Although biodiversity has been traditionally appreciated at species level, the appreciation at landscape level has been given much emphasis globally as there exists some understanding of the interactions of the different components of the biological diversity at landscape level. Remote sensing and GIS describes landscapes spatially and helps to identify the frequency, boundary size and shape of the landscape components. Further more the biodiversity characterization at landscape level provides critical inputs to the prioritization and conservation zoning.

A national level initiative by DOS-DBT in the form of Biodiversity Characterization at Landscape Level an outcome of 68 scientists, 27 universities and 56 research scholars has resulted in generation of spatial database on the vegetation types, ecological unique habitats Disturbance regimes and Biologically rich areas. The project has been carried out in two phases. The phase I covered the Western Ghats, North Eastern Regions, Western Himalayas and Andaman and Nicobar Islands, while phase II of the project covers Central India, Eastern Ghats and East coast and West Bengal. A total of around 12000 sample plots with accurate geo-locations across all the vegetation types have been sampled in the two projects, which can also be revisited for future work on change analysis as a result of the global change. The database developed the first of its kind, will serve as a basic input for all types of ecological studies and would serve as a benchmark for further studies.

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TI–10 FOREST BIODIVERSITY RESOURCES OF KERALA

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Forests are renewable resources encompassing millions of living organisms, both plants and animals living in perfect harmony with nature. As man continues to exploit natural resources both renewable as well as non-renewable, the extent of resources is the key resource to which we and our future generations depend for existence. Of different types, tropical rain forests are considered as the most biodiversity rich vegetation type in the world; they constitute only 7 percent of the total forests of the world, yet sustain 56 percent of the known plants and animals. In Kerala, the varied topographical features, high rainfall and geologic conditions have favored the formation of different forest ecosystems from grasslands at the top and shola forests in the mountain valleys to the mangrove forests along sea coasts and estuaries accounting to a total forest cover of about 9400 Km^2. The most outstanding feature of forests in Kerala is the formation of tropical rainforests now confined to higher reaches of the Western Ghats. In the rain shadow region, the forest vegetation is dominated by dry deciduous forests and scrub jungles; the wetlands are mostly confined to the low land region of the state. Western Ghats being the hot spot of biodiversity, Kerala forests are rich in several endemic and rare plant and animal species. Plants are represented by 4500 species of Angiospems, 4 Gymnosperms, 328 Pteridophytes, 168 Pryophytes, 745 Lichens, 284 Algae and about 4800 Fungal species. Animal diversity is equally rich represented by 6000 insects, 552 invertebrates, 150 reptiles, 196 fresh water fishes, 90 amphibians, 539 birds, 75 mammal species. Of the total of 750 species of tree species in Kerala 35 percent are endemic to the Western Ghats. There are at least 497 plant species which come under the category of RET which need to be conserved. During the past few years KFRI has relocated some of these RET species considered to be possibly extinct. Kerala forests are equally rich in plant species (about 500 plant species) yielding different types of non- wood forest products such as medicinal plants, gums and resins of which majority of them are medicinal plants. These NWFPs are traditionally gathered by the tribal communities. One of the major challenges in forestry is the conservation and sustainable utilization of forest resources, especially NWFPs. The paper will discuss the current status of forest resources of Kerala and major challenges in their conservation and sustainable utilization.

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TI–11 STUDIES ON THE ANATOMICAL ADAPTATIONS OF SOME LIANAS AND CLIMBERS OF INDIAN FORESTS

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Climbers and lianas in the forests exploit diverse kind of adaptations to cling and climb to trees or other supports for their upward extension. Twining is an efficient method but requires longer stems than climbing by hooks, roots, tendrils or swinging branches. Their stems require to be held firmly to the support, be pliable, flexuous but tensile. These must be capable of withstanding different shearing and compressive stresses. Besides, there is the demand for facilitating ascent of sap particularly in the stems of some of the lianas which far exceeds in length/height the tallest trees.

The adaptations which have been generalized are: marked increase in the incidence of anomalous secondary growth; an increase in both vessel diameter and proportion; an increase in ray size/ parenchymatous tissue and proportion and an increase or decrease in the proportion of fibre. Variable cambial activity usually leads to anomalous secondary growth. The adaptive functions attributed to variable stem structures are increased flexibility, phloem protection, increase in storage parenchyma and in aid to reiteration and climbing (Schenck, 1893; Haberlandt, 1914; Richards, 1952; Carlquist, 1975, '88; Gentry, 1978; Fisher & Ewars, 1989, '92; and Putz, 1990).

The present paper deals with anatomical studies of 42 species, of which 22 are twiners, 3 branch climbers, 6 are root climbers, 3 are tendril climbers in the dicotyledons and 4 twiners, 2 tendril climbers, 1 each of root and branch climber in the monocotyledons. Observations of anatomy deal with outline in transverse section; presence and nature of cork; nature, distribution and number of vascular bundles; position and distribution of phloem; presence and nature of idioblasts; nature, number, size of vessels per unit area; nature of ray; nature of axial parenchyma; nature and distribution of mechanical tissue; nature of pith and position of cambium and derivations or anomalies there of, if any.

In twiners, anomalous secondary growth due to successive cambia both centrifugal and centripetal are observed besides the formation of inter- and intraxylary phloem. But not all twiners can be expected to show any of the specialized anomalous structures. Tendril climbers examined showed either the formation of successive cambia and xylem in plates or interxylary phloem patches. Of the branch climbers examined, the notable feature being partial and bipolar activity of cambium leading to band shaped or winged development of stems though others may not show any abnormal activity. Some of the root climbers may show abnormal conformation or dispersion of cambia. Within the monocotyledons the common feature is the formation of fibrous sheath surrounding the vascular bundles, which may be cortical and medullary and sometimes differing in shape.

Generally, branch climbers show high vessel density. Vessel diameter increases with the onset of secondary growth. Vessels are formed either early or late during the secondary growth. Presence of continuous ring or patches of sclerenchyma, sometimes between the phloem and periderm or within the pericycle is a

common feature. Bastfibres often surround individual vessels providing additional mechanical strength. Diameter of the pith is larger mostly in the twining species than in other forms. In some branch climbers, brachysclerides or bastfibres are present through out the pith.

The anomaly seen in the stem anatomy is believed to limit mechanical damage of twisting, bending, and friction. Sclerenchymatous sheath surrounding the vascular bundles provide resistance to breakage. Parenchymatisation or formation of wide pith helps in cable construction. Axial parenchyma helps in stem flexibility. Wide thin walled rays protect vessels from damage during torsion. Comparatively fewer anomalies are seen in tendril, hook or prickle climbers as they are less susceptible to torsion.

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TI–12 GENETIC DIVERSITY AMONG ONE-PARENT FAMILIES OF NEEM (*AZADIRACHTA INDICA* A. JUSS)

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Twenty six geographically diverse one-parent families of neem collected from 16 states of the country were grown at Forest College and Research Institute, Mettuplayam. Observations were recorded on nine quantitative and nine qualitative traits from eighteen months old plants established in the field. For marker analysis, data sets derived from six isozyme systems and sixteen RAPD primers were used.

Both the morphological and marker data sets indicated the existence of significant genetic diversity among Indian neem. The morphological traits such as leaf serration, leaflet shape, terminal leaflet shape, and petiole colour varied widely across the one-parent families for their phenotypic classes. The isozyme systems peroxidase, polyphenol oxidase and malate dehydrogenase and the RAPD primers OPC 7 and OPC 24 were identified to exhibit considerable polymorphism.

Multivariate analysis using hierarchical clustering and principal component analysis indicated lack of parallelism between geographical and genetic diversity. Statistical comparison of the genetic distances indicated that the different morphological and marker data revealed different diversity patterns among the one-parent families.

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TI–13 LACCASE ENZYME POLYMORPHISM AND GENETIC RELATIONSHIP IN GERMPLASM OF *JATROPHA CURCAS* L

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Jatropha curcas Linn., a genus of Euphorbiaceae, is a native of Mexico and tropical South America, but naturalized now throughout tropical and subtropical Asia and Africa. The plant is reported to have been introduced into Asia and Africa by Portuguese as an oil yielding plant. It is a multipurpose, deciduous, large, 3-4 m high shrub and is commonalty known as Physic nut, Ratanjyot, Chandrajyot, Jamalghota, Jangli arandi or Kala aranda. Now it is occurring almost through out India including Andman Islands in semi wild condition. In India, it is reported to be cultivated in Central and Western parts like Rajasthan, Madhya Pradesh, Chhatishgarh, Maharashtra and Gujarat. Similarly, there are reports of its cultivation in southern states like Andhra Pradesh and Tamilnadu. Due to the wide adaptability and its distribution to large geographical area of country i.e. from Himalayan region in north to Tamilnadu in south and Gujarat in west to North-east India, there is enough possibility of variation in this species. High variability provides ample opportunity for selection of desired types and success in breeding programme.

The genus comprises 160-175 species of shrubs, rhizomatous shrubs, herbs and small trees. About nine species of Jatropha have been recorded in India. Out of these, important ones are, *Jatropha curcas* Linn., *J. gossypifolia* Linn., *J. glandulifera* Roxb., *J. multifida* Linn., *J. nana* Dalz. and *J. podagrica*, with *J. curcas* fairly well distributed in areas ranging from arid to sub humid and even to some extent in wet tropics.*J. curcas* is a monoecious, protandrous and pantropical shrub. Flowering occurs in the hot and rainy season. The peak period of flowering is July to August. Numerically, 1-5 female flowers and 25-93 male flowers are produced per inflorescence. Male flowers are quite similar to the female flowers in shape, but are relatively smaller. Both flower sexes open synchronously. The sexual system facilitates geitonogamy and xenogamy. The flower visitor includes bees, ant, thrips and flies. Bees and flies affect geitonogamy and xenogamy, while ants and thrips affect only geitonogamy. By predominantly cross-pollinating, the plant throws open the possibility for geitonogamy. Fruits are set in September and mature by October-November, when the shrub starts shedding their leaves.
In irrigated condition, fruits can be obtained up to November. However, it may produce 2-3 crops during the year if soil moisture is not a limiting factor. The fruits are 2.5 cm long, ovoid, black and 2-3 halved. The seeds resembles to castor seed in shape, but smaller in size.

Fifty accessions of *Jatropha curcas* L. were analyzed for their ability to produced laccase enzyme and on the bases of laccase activities, polymorphism of *Jatropha curcas* L. was also studied at the genetic level through spectrophotometrically. Among forty accessions NRCJ-32 produced higher activities of laccase whereas NRCJ-75 showed low production of this enzyme. The difference observed in the enzyme activities between accessions was found to be adequate for analyzing the extent of genetic variability at the intra-specific level. The analysis revealed that highest genetic identity between NRCJ-32 vs. NRCJ-75 (286.58%) whereas lowest

(1.02%) between NRCJ-54 vs. NRCJ-79. This information generated will address to obtain more knowledge about growth, development pattern and plant defense mechanism of *Jatropha curcas* L. in term of enhance yield and its components. These accessions further combination can be selected as genetically diverse parent for intra specific hybridization in *Jatropha curcas* L. to exploit heterosis.

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TI–14 PHYLOGENETIC PLACEMENT OF *WITHANIA* WITHIN SOLANACEAE- SUPPORT FROM MOLECULAR DATA

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Withania is a well-known genus of the family (Solanaceae) with widely known species of great economic importance. The genus *Withania* consists of 26 species found throughout the world, many of which are medicinally very important. For better, optimum and sustainable commercial exploitation of any taxon, knowledge of its biodiversity and phylogenetic position is very important. Many species of *Withania* like *W. qaraitica* and *W. sphaerocarpa* have been described as lately as 1988, indicating that the genus being so important is so far poorly described. Further, many authors have time and again raised certain varieties of *W. somnifera* to the species status and in a number of instances some species of *Withania* have been transferred to the genus *Physalis*. Though Solanaceae has served as model family but the attention has mainly remained restricted to fewer genera and so paucity of knowledge about other genera like *Withania*. Generation of sequence data in the last few decades has provided opportunity to assess the relationship of various taxa in the Solanaceae in phylogenetic terms. To resolve the relationship of *Withania* with other genera of Solanaceae, the use of molecular data is pertinent and has advantage that it provides much more informative data that can be analysed more objectively and stastically than morphological data. Ribosomal genes along with the spacers and chloroplast genes are found throughout the plant kingdom and are customarily used to resolve taxonomic queries at generic and above levels. In the present study, sequence data of 18S rRNA, the 5' end of external transcribed spacer flanking the 18S, ribulose 1,5-bisphosphate carboxylase large subunit gene (*rbcL*) and ATP synthase beta subunit (*atpB*) gene were used for this purpose.

The data for *Withania* was generated from the three species (*W. somnifera*, *W. coagulans* and *W. frutescens*). The sequence of other representative species of Solanaceae and some of Convolvulaceae (as outgroups) were obtained from public domain (http://www.ncbi.nlm.nih.gov) and analysed together with the data of *Withania* sp. Our data confirms inclusion of genus *Withania* within subfamily Solanoideae. Further, the studies showed as in many taxonomic treatments its close kinship with genus *Physalis*. However, the data clearly showed that the genus is well distinct from the later one. Further, the data confirms that the *Withania* is relatively close to *Solanum, Datura* and *Lycopersicon* (all included in Solanoideae) and with *Nicotiana* (Nicotianoideae) than to *Petunia* (Petunioideae) on the basis of *rbcL* data. The data also seems to support

common ancestry for the clades of Solanoideae and Nicotianoideae, which share 12 as basic chromosome number. Within the genus, *Withania* certain substitutions appear to be specific for *Withania*. While the species among themselves as expected differ in fewer nucleotide positions with synonymous substitutions.

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TI–15 DIVERSITY AND DISTRIBUTION OF *MORINDA* SPP. IN INDIA

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The genus *Morinda* includes trees, shrubs and vines and distributed world wide especially tropical coastal regions. Predominantly they grow as weed in agricultural land especially in vacant and uncultivated lands and boundaries of cultivated lands and few species were distributed in coastal region like West coast, Andaman and Nicobar islands. Ancient literatures have shown that *Morinda* has been cultivated in different parts of India. Our ancestors have very well aware the biological properties of *Morinda* and they used it in their traditional system of medicine. However, documentation has not been done properly as a result, only the local people know about its wealth. Hence the present study is focused to explore the diversity that exist within the species of *Morinda* and its therapeutic potentials. Extensive survey made on the diversity of *Morinda* has revealed the presence of nine distinct species or varieties of *Morinda* in India. Among them *Morinda pubescens* is distributed in most parts of India and *Morinda citrifolia* is distributed in coastal regions of Karalla, Andaman and Nicobar. Species of *Morinda* have shown variation in size and shape of leaf and fruit. Herbarium and germplasm of *Morida* spp. of different ecotype are being maintained at our laboratory.

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TI–16 FLORISTIC ANALYSIS AND DISTRIBUTION OF RATTAN IN MANIPUR AS A SUSTAINABLE BIORESOURCE

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A survey of distribution and floristic analysis of Rattan **species** available in the 9 district of Manipur State was conducted during the period from 2000 to 2005. During the survey, 14 species were collected. Out of the total Rattan 6 species were found to be new records from this state .Maximum number of 5 species was collected from Tamenglong ,Churachandpur and Imphal East District;4 species were collected from Senapati

, Chandel and Imphal West District; 3 species from Ukhrul District and 2 species from Thoubal and Bishnupur District respectively . Inorder to know more about the distributional pattern of Rattan species , I V I (Importance Value index) of all the 14 Rattan species was also calculated with 1 Transec =1m^2,5 transec in plot .The least IVI is found in *Calamus erectus* Griff. Of about 27.9 and its population type is accidental type. And the highest IVI is found *Calamus pseudotenius* Mart. Of about 237.4 and the type of population found is expanding type .Their Species distribution is more in forest area and hill than the plain area

Rattan is one of the minor forest product (MFPs), which is also ethnobotanically importance next to bamboo to all the communities of the state, but due to heavy extraction from the forest and rapid urbanization the population of Rattan has become an endangered one. It is one of the rich bioresourse of Manipur. Their distributional pattern will give the idia of conservation in the natural home of the cane species.

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TI–17 SYSTEMATICS AND DISTRIBUTION OF EPIPHYTIC PTERODOPHYTES IN MANIPUR VALLEY

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Manipur, a part of Eastern Himalaya falls under one of the hot spots diversity centre for pteridophytes. The presence of diverse ecological habitats provides an ideal home for the luxuriant growth of pteridophytes. But pteridophytes in this very region have not been thoroughly explored and still lacks a conspicuous work on its flora. As epiphytic pteridophytes constitute an important supplement to the terrestrial ferns, a comprehensive floristic study is needed. With a view to provide in due course an accurate information on the diversity of epiphytic pteridophytes distributed naturally in Manipur valley, a survey programme was conducted during Jan-Dec, 2005. A total of 21 species of epiphytic pteridophytes was collected. Out of these plants, 7 species were found growing in extremely rare condition. The present study also encompasses distribution pattern, host epiphyte association, categorization on the position of attachment on repository trees, and other important notes along with their conservation strategies.

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TI–18 SEASONALITY OF FLESHY FRUITING TREES IN THE SHOLA FOREST OF PALNI HILLS

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Most tropical rain forest trees produce fruits that are consumed by animals and rely on frugivores for their seed dispersal. Many of the tropical tree species are strictly seasonal in flowering and fruiting and it could be defined as variations in (a) the number of species in flower or fruit (b) the proportion of plants having flowers or fruits and(c) the abundance of flowers or fruits over time. Monitoring plant phenology is imperative for the description of temporal variation in resource availability for frugivores. Therefore, an understanding of fruit resource availability patterns would give a better insight into response of the frugivores to phenological changes and the vagaries of food abundance. Hence a phenological study was carried out in the shola forests of Palni hills from April 2002 to May 2004. Phenology of the major fleshy fruit species of plants was studied by selecting 10 individuals of each species in the same area following Guy et al. (1979). All the fruiting trees in 1 sq. m plots was counted and labeled by metal plates and monitored monthly twice. When the fruits appear, they were noted and monitored. The phenological events were divided in to two phases, namely vegetative and reproductive assigning the values ranging from 0-100% for each phase. An approximate proportion of flowers, fruits and young leaves were recorded. Phenological monitoring shows 23 species of trees were fruiting with one major fruiting peak in July 2003 and the least fruiting in June 2002. During the peak fruiting period 85 individuals of 6 species were observed. The total fruit production had significant correlation with total rainfall($r = .40$; $p < 0.05$) but not with other environmental factors. The number of species had significant correlation with maximum and minimum temperature ($r = .39$; $p < 0.05$, $r = .67$; $p<0.01$). Shola tree communities display conspicuous seasonal pattern in vegetative and reproductive phenologies at both community and species levels.

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TI–19 BIOSYSTEMATICS STUDIES ON *URGINEA INDICA* KUNTH. LILIACEAE

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Urginea is one of the extremely interesting polytypic genus with about 100 species Endemic to India, Africa and Mediterranean regions. *Urginea Indica* is among the most potent, Preventive & therapeutic agents known. The bulbs contain literally hundreds of compounds that defend cells against attack by Marauding free radicals by blocking the development of heart diseases, cancer, Rheumatism dropsy, edema, gout. Asthma, Dog bites, cut wound, Infertility in man & numerous other life shortening aliments. Due to these properties the

bulbs have found its place in British & European Pharmacopiaes. *Urginea Indica* seems to be an excellent material for the study of phenotypic and genotypic plasticity as revealed by their morphological & cytological studies.

In the present study thirty two different races were explored for their Karyotype attributes using different Parameters which revealed the presence of diploids, triploids, tetraploids, aneuploids & hexaploid populations. Morphological anatomical, sem, stomatal studies revealed several variations.

Population two was characterized for its biochemical properties. Crude extract of bulbs revealed antifungal & antitumors activity, subsequently, Isolation, purification & characterization of a 26 KDa protein revealed antifungal activity against the growth of Pathogenic fungus *Fusarium oxysporum* & *Rhizoctonia solani.*

Polyclonal antibodies were raised against purified protein in order to uniquely identify this protein in total protein, extracts of Indian squill bulbs. 26KDa protein was sequenced & blast search analysis results indicated that this sequence has approximately 70% homology to 29KDa protein of *Sorghum vulgare* which is categorized into class IA endochitinase. The major function of this Endochitinase is to hydrolyze the fungal cell wall & inhibiting the growth of fungus.

Treatment of seeds (Chilli, tomato, Paddy, pearl millet & Sorghum) for 12 to 24 hours with pure protein protected the seeds from fungal attack *Fusarium Oxysporum* & *restored* both seed germination & seedling vigour.

Further our results on immunofluorescence indicated that the protein is constitutively, expressed & are localized in the cell wall of the squill bulb.

The protein was heavily glycosilated with a ratio of protein to carbohydrate 3:1. A positive staining using periodic acid schiff's stain confirmed that the 26 KDa Protein is a glycoprotein.

Cloning of the novel protein is currently being carried out for the production of transgenic plants resistant, to fungal infections.

The 26 KDa protein showed inhibition of proliferation of Mouse mammary Carcinoma cells in vivo as verified by body weight of the animals bearing tumor cells, cells number & formation of tumor ascites fluid. This is a novel report describing unique biological activities of a protein from *Urginea Indica.*

The nutrient value of *urginea Indica,* minerals, vitamins & heavy metals analysis have also been made in *Urginea indica.*

Vam Fungi is noticed in few populations of Urginea indica.

The isolation of genomic DNA in different population of *Urginea indica* and RAPD analysis has shown that the populations differ strikingly in their banding & in their DNA content. Finally to conclude our article is an investigation aimed at making Indian squill an economic & medicinally important plant for India.

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TI–20 EFFECT OF *SIMAROUBA GLAUCA* ON NATIVE FOREST IN TAMILNADU A CASE STUDY

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Simarouba glauca, commonly known, as Aceituno or paradise tree or Simaruba oil tree is an introduction from El-Salvador of Central America. This tree was first introduced to India during 1966, at Plant Introduction Substation, Amaravathi (Rath, 1987). It's cultivation was then extended to Tamil Nadu during 1989 as test crop. This tree is regarded as highly suitable for growing on both arable and nonarable wastelands, where in the rainfall ranges from 600 – 2500 mm. The kernels, which form 92 % of seeds, yield 55 – 60 % oil on decortication. A well-established tree gives an oil yield of 0.6 – 0.8 t/ ha after ten years of it's planting.

Ten-year age old stand available at Forest College and Research Institute, Mettupalayam (11^0 19' N, 76^0 56'E, 300 m.m.s.l, 800 mm and pH 7.1) of spacing trial is the study site for this experiment. There are nine plots with the size of 2 X 2 m under tree was marked with nail and thread. This plot is used to observe the flora diversity under this exotic tree. Meanwhile the trees of this stand were observed for the fauna diversity also. This experiment was carried during a full year (2000) to assess the effect of this exotic on the undergrowth population and the fauna population.

In this experiment the undergrowth flora observed can classified as the population consists of two tree species, four grasses, three shrubs and eight herbs. The undergrowth was observed with heavy light requirement and there is no competition observed between Simarouba and the under growth. Hence this tree is an evergreen fruit-yielding tree (season: March – April), it invites very good deer population as well as the tree dwellers Viz., monkey and birds like crow, crow pheasant, myna, koel and parakeet. The above observations along with Simarouba's natural regeneration potential, earlier observed by Ratha Krishnan *et al.* (2005) spells the acclimatization of this species to this newly introduced area. This article is an attempt to register the naturalization of this introduced exotic on its foreign soil.

TI-21 STUDIES ON THE STRUCTURE OF CHARMADY RESERVE FOREST, DAKSHINA KANNADA DISTRICT OF KARNATAKA, INDIA.

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The structural studies of Charmady reserve forest near Belthangady of Dakshina Kannada district, India were carried out. In the 5000 m study area, 99 species belonging to 84 genera and 47 families were recorded, of which, only 67 tree species belonging to 37 families were with girth at breast height (GBH) > 10 cm. The endemism is fairly high with 37 species endemic to the Western Ghats. The forest is of evergreen type with the dominance of members of Dipterocarpaceae like, Dipterocarpus indicus, Hopea ponga and Vateria indica, members of Fabaceae like, Humboldtia brunonis and members of Rubiaceae like, Ixora brachiata etc. The forest floor is fully covered by the canopy without any openings. The seedlings of few species are more and there is moderate regeneration in the forest.

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TI-22 A FLORISTIC ANALYSIS OF THE SHOLA FORESTS OF KUDREMUKH IN KARNATAKA

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Shola forests are evergreen forests found usually at altitudes above 1800 m in the hills of peninsular India. The hills of Karnataka harbors Shola forests even though, these are at lower altitudes. A study has been conducted using line transects to know the change in the floral composition along the altitude. These studies indicate that forests above 1600 m altitude are more comparable to the Shola forests found at higher altitudes in other parts of the peninsula. The Shola below these altitudes are more akin to the medium elevation evergreen forests in their floristic composition. In this study, 203 woody species were recorded. Of this, 50 species are recognized endemic species of the Western Ghats. As many as 13 of these are listed as rare and threatened and vulnerable. Also, three genera endemic to the Western Ghats are recorded here. These are Poeciloneuron beddome, Otonephelium radlk and Kunstleria prain. The region is rich floristically and in terms of endemic and threatened plants and needs to be conserved.

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TECHNICAL SESSION - II

BIODIVERSITY THREATS, ENDEMISM AND RET SPECIES

TII–01 REPRODUCTIVE ECOLOGY OF FOREST PLANTS OF INDIA: RESEARCH INSIGHTS AND MANAGEMENT IMPLICATIONS PERTAINING TO THEIR EXPLOITATION AND CONSERVATION

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The unabated devastation of forests has become one of the most pressing issues of our times. Not only are the rates of deforestation very highe, but also approximately more than 50% of the existing forests have been degraded in recent times. It is estimated that the existing tropical forests will largely disappear in about 50 years, except for those that might conserved for as nature reserves. Obviously there is a need for greater investment in scientific research in ecology, conservation and management of forests worldwide. This is true for India as well.

There are three crucial interrelated issues that a manger of forests must address: (i) depletion of forest biodiversity resources, (ii) regeneration and restoration of forest ecosystem and (iii) conservation of forest genetic resources. The challenges caused by the reduction and degradation of forests can be adequately met only if serious attempts are made to manage and restore forest ecosystems. Coupled with restoration, conservation of existing genetic resources is of very high priority. The biodiversity resources to be conserved and the manner in which they have to be conserved are very serious issues requiring sustained and strong scientific researches.

The best way to go about conserving any forest biodiversity resource is to make a scientific study of reproductive ecology of plants, animals and microbes of forests. Most importantly the reproductive ecology of forest plants needs to be focused to start with since the animal bio-resources depend directly or indirectly on plant resources. The reproductive ecology of plants has to be studied with special reference to reproductive allocation, phenology, plant-pollinator interactions, sexual systems, gene flow, genetic variations, seed and fruit dispersal, seed physiology and germination, seedling ecology and regeneration etc. Forest plant improvement programmes can be taken up in all seriousness only if the above aspects of the reproductive biology of forest plants are known.

This talk will highlight what is known and what is unknown with reference to the key aspects of the reproductive ecology of forest plants of India. It will also highlight the forest plant improvement programmes that are to be undertaken immediately in the Indian context.

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TII–02 STAND DYNAMICS AFTER SELECTIVE LOGGING IN A WET TROPICAL FOREST OF THE WESTERN GHATS, KERALA, INDIA

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In a humid evergreen forest of the Western Ghats of India, density and basal area of primary, late and early secondary tree species, both in seedling and tree phases in the undisturbed plot were compared with those in a) selectively logged plots representing post-logging period ranging from 14 years to 23 years, and b) area around the logged tree and area covering coupe roads and adjacent to them within each selectively logged plot. Although, the basal area of primary species in tree phase in selectively logged sites can become equal to that in un-logged forest when the post-logging period is around 20-25 years, seedling and tree density and seedling basal area remained less in selectively logged plots. The study also demonstrated that the primary species showed less fluctuation in population size due to post-logging period differences. When compared with the un-logged primary forest, selectively logged plots still retained the structural characteristics typical of secondary forests such as significantly more density and basal area of secondary species. The study also indicated that the secondary species are sensitive to post-logging period. However, time required for the selectively logged forests to have value of a given parameter comparable to that in un-logged primary forests can differ with less time for the density to reduce than for the decline of basal area of trees of secondary species. When compared with the un-logged primary forests, the recruitment of late secondary species in logged forests continues to be more up to 32 to 36 years after logging. Similarly, the estimated time for the secondary forests to resemble primary forest in terms of seedling and tree density of early secondary species ranged from 48 to 69 years. At this slow rate of decline in density, it is expected that more than 80 to 90 years since logging will be required for the secondary forests to simulate the primary forests in terms of secondary species composition and basal area. Thus it is concluded that the degree of disturbance caused by selective logging in this evergreen forest is severe and that the felling cycle of prescribed 40-45 years is too short for the forest to recover from the selective logging impacts.

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TII–03 MORPHO PHYSIOLOGY AND BIOLOGY OF INVASIVE ALIEN SPECIES OF WEEDS: A MAJOR THREAT TO BIODIVERSITY

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The alien invasive species are aggressive invaders outside their natural range and have been recognized as the second largest threat to biological diversity and other natural resources after habitat destruction. The impacts of alien invasive species are immense, insidious, and usually irreversible. They are present in India for

over a century and some of them are world worst invasive alien species of weeds. Hence, the study highlights the morpho physiological and biological behavior of invasive species of weeds ie., *Eichhornia crassipes, Parthenium hysterophorus, ,Celosia argentea, Galinsogha parviflora* studied at Raipur, Chhattisgarh region . Morphological studies for plant height, number of leaves, leaf area, dry matter production , seed yield (seed production potential) , biological yield,, germination behavior , dormancy period , greater production potential lead to greater population turnover in man modified ecosystem. Physiological studies also revealed that these weeds possessed higher rate of photosynthesis, transpiration and stomatal conductance as compared to the cultivated crops and high tolerance against the environmental extremes are some probable traits of biological invasiveness.

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TII–04 IMPACT OF OIL FIELDS IN THE BIO DIVERSITY OF SOLA AND ABHOYPUR RESERVE FORESTS, ASSAM

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The Charaideo Sub-division of Sivasagar district of Assam is situated in the north eastern region of India and lies between 94º8'-95 º 4' East longitudes and 26º7' – 27º2' North latitude. Major area of Charaideo sub-division is covered by the well-known Lakwa oil fields since last five decades. More than 200 oil fields are successfully operated by ONGCL and cause several damages of the area. Among the five reserve forests of Charaideo sub-division, Sola and Abhoypur reserve forests are highly polluted due to the drilling operations and others which cause habitat loss and habitat fragmentation and plants utilized for timber, medicinal, fiber etc. purposes have been reported along with the endemic and threatened plants of both the disturbed and undisturbed areas.

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TII–05 THREATS TO BIODIVERSITY IN FOREST ECO SYSTEM – SIXTH SENSE

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Biodiversity means the variety of life forms of plants and animals, the ecological roles they perform and the genetic resources they condition. The global level Biodiversity exists 5-30 million species of living forms on our earth and of these, only 1.5 million have been identified and include 3,00,000 species of green plants and fungi, 8,00,000 species of insects, 40,000 species of vertebrates and 3,60,000 species of

microorganisms. Estimated number of species worldwide in Mammals-4008, Birds-9036, Reptiles-6300, Amphibians-19056, Fishes-6100, Gymnostperms-750, Angiosperms-250000, Insects-750000 and etc., in our India the wide variety in physical features and climatic situation have resulted in a diversity of ecological habitats. In India level number of recorded biota in Angiosperms-17000, Gymnosperms-64, Mammalia-44, Angiosperms-4950, Mammals-372, Birds-1228, Reptiles-428, Amphibians-204, Fishes-2546 and etc., The Foremost Threat to forest biodiversity is industrialization, forest based industries, Hydel-irrigation projects, mining, oil drilling, resource extraction, road and transport are all effects of development which severely affect forest biodiversity. Encroachment by means of expanding agriculture, conversion of forest land to non forest purpose uncontrolled grazing, monoculture forestry, new settlement, shifting cultivation, siltation of river beds all are causes for decrease in forest area. Biodiversity conservation is the need of the hour for it is necessary ensure livelihood ranging from food security to resource utilization. The rate of growth population must be reduced greater emphasis should be given to better management of available biological resources. Maintenances of adequate resources, conservation of resources through reduction in demand and achievement of greater end use, maximum use of renewable resources, reduction in dependency of non renewable resources are key to biodiversity conservation.

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TII–06 IMPACT OF TSUNAMI IN THE COASTAL FORESTS OF BARATANG ISLAND, M. ANDAMAN

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The unpredicted Tsunami, which occurred on 26th December 2004, has shattered the daily life of the islanders considerably and in several places it collapsed the life forever. A survey was made to asses the impact of Tsunami to the coastal forest vegetation in Batarang Island, Middle Andaman. The survey was carried out in two sites (i) 12^{0}08'24.3''N & 92^{0}49'08.3''E (Baludera) facing SE direction and ii) 12^{0}07'02.6''N & 92^{0}48'41.6''E (Padakthala) facing E direction. The littoral forest in Baludera affected by tsunami even though it is guarded by Peel Island, and Havelock Island, and Ariel Island. Seawater entered up to 130m, of which about 70-80m was occupied by littoral forests followed by paddy field. Soil pH observed in 0-10m from the seashore is 9.0 and 8.7 in 60-70. EC varied from 2.83 to 0.58 dSm^{-1} respectively. The pH and EC of the affected paddy field is 8.0 and 0.985 dSm^{-1}.

In Padakthala area almost entire coastal forests (50-60m distance) were submerged by seawater initially and during high tide period seawater enters frequently with a height of about 1-1.5 m. Some of the sea mohwa trees, which are nearer to the sea, were uprooted. *Cycas rumphii* an endangered species are dying / dead due to the continuous invasion of seawater. In-situ and ex-situ conservation of this palm may be initiated

to avoid extinction. The pH ranges from 9.3 (0-10m) to 8.5 (40-50m) and EC rises from 3.88 dSm^{-1}.

To reduce the impact of Tsunami, it is necessary to strengthen the existing and damaged mangrove forests. The tree species viz., *Pandanus tectorius, Pandanus andanensium, Manilkara littoralis, Hibiscus teliaceus, Lannea grandis, Morinda citrifolia, Syzygium claviflorum, Guettarda speciosa, Pongamia pinnata, Calophyllum inophyllum, Casuarina equisetifolia, Jatropha curcus, Gliricidia sepium, Bombax insigne, Myristica irya, Pterocymbium tinctorium, Bombax insigne, Blachia andamanica etc.*, were recommended for biofencing in the coastal area.

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TII–07 IMPACT OF ROAD METAL MINING ON PLANT DIVERSITY OF RAJMAHAL HILLS (JHARKHAND)

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The Rajmahal hills, situated in Santhal Pargana Division of Jharkhand, lie between 24°20'-25°20' north latitude and 87°20'-87°45' east longitude. The hills extend in the north-south direction for about 122 km from near the river Ganga at Sahebganj to as far south latitude as 24°20'. In the east-west direction it is about 48 km wide near the centre of the hills, but it contracts to about 20-25 km in the north and south. To the north and east, this range is bounded by the river Ganga and in the west and south by the undulating plains of Godda and Dumka districts. The hill range consists of succeeding hills, plateaus, valleys and ravines. The general elevation of the hills varies from 150-250 m above sea level, though some hills have an altitude of 450 m and at some places exceeds 600m. The hills have mostly flat tops. The Barhait valley is the central valley of the hills and it extends over 38 km from north-south with an average width of 8 km. Brahamni, Bansloi and Gumani, which arise in these hills, are the hill streams which drain this area.

In recent years, due to large scale mining, this region is highly disturbed. There are more than 800 road metal mines in Rajmahal hills spread over Sahebganj, Godda, Pakur and Dumka districts of Jharkhand. Our survey has revealed that forest cover is going down due to mining of road metal and a large number of species have become rare and threatened. Taxa which have become extremely rare include *Alphonsea ventricosa, Aphanamixis polystachya, Artemisia carnifolia, Athroisma laciniatum, Balanophora polyandra, Caryopteris bicolor, Ceropegia hirsuta, Dalbergia malabarica, Diospyros sylvetica, Entada pursaetha, Eriolaena stockii, Ficus nervosa, Helinus lanceolatus, Heteropanax fragrance, Hyptianthera stricta, Ixora undulata, Ligustrum robustum, Luffa graveolens, Mallotus roxburghianus, Neonauclea purpurea, Opilia amentacea, Pterocarpus marsupium* var. *acuminata, Schefflera venulosa, Uvaria hamiltonii, Xantolis tomentosa.* Some rare species which have become threatened due to mining activities are *Atlantia*

monophylla, Beilschmiedia dalzellii, Bischofia javanica, Byttneria grandifolia, Carallia brachiata, Clematis gouriana, Clerodendrum serratum, Cordia macleodii, Derris cuneifolia, Entada pursaetha, Eulophia explanta, Gastrochilus inconspicuos, Gloriosa superba, Hyptianthera stricta, Iphigenia indica, Lasia spinosa, Lepisanthes rubiginosa, Musa paradisiaca, Neuracanthus tetragonostachys, Pelatantheria insectifera, Rauvolfia serpentina, Salix tetrasperma, Siphonodon celastrineus, Tacca leontopetaloides, Vitex glabrata, Vitex peduncularis, Wrightia arborea, Xylosoma longifolia.

Mining activities have resulted in establishment of aggressive weeds like *Acanthospermum hispidum, Cassia hirsuta, Ipomoea hederifolia, Parthenium hysterophorous, Solanum macaranthum, Lantana camara* var. *aculeata, Chromolaena odorata*. These alien weeds are adversely affecting indigenous flora of Rajmahal hills making hill forests unproductive as well as poorer in species diversity. Both ex-situ and in-situ conservation measures are needed to save the rare and threatened species in mining areas of Rajmahal hills.

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TII–08 RANGELAND FIRE – ORIGIN, INFLUENCES AND MANAGEMENT

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Rangeland fire in tropical countries in particular has notable influence on community structure and functions. The successional pattern and directions of community development are altered drastically by the recurrent annual summer fire. In many rangelands at global level proscribed burning is practiced with adequate care to design the composition and structure of vegetation so as to avoid wild fire and to get desired characters as well. This paper deals with the occurrence, influences on vegetation structure and functions and management of wild fire at global level.

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TII–09 INTERFERENCE OF SIXTH SENSE ACTIVITIES IN THE CARBON DYNAMICS OF FOREST ECOSYSTEM AND ITS MANAGEMENT OPTIONS

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Forest ecosystem is the one of the most important terrestrial ecosystems of the world. Among three forest ecosystem, boreal coniferous forests, forests of temperate belt and tropical rain and monsoon forests, the last one maintains it's well functioned ecosystem. An outstanding feature of these forests is the richness and diversity of the biotic community. More species of plants and animals live in tropical rain forest than in the other entire in world biomes combined. Apart from providing a number of products, forest perform an irreplaceable ecological service such as shaping of natural environment by influencing such factors as temperature, humidity and precipitation; play an important role in bio-geo chemical cycles of water, carbon, nitrogen, oxygen, phosphorous, sulphur and a number of other elements; checking of soil erosion by obstructing currents of water or air; recharging of ground water resources; provide suitable habitats for a number of important plants and animal species and act as an effective sink for a number of pollutants. But the accumulation of human biomass, pollution of environment and over exploitation of natural resources have become so extensive as to threaten the existence of various ecosystems including forest ecosystem or entire life on this planet. It was with the beginning of agriculture, animal husbandry, and settled life that the destruction of natural ecosystems particularly forest ecosystem have been started. Rapidly growing human population and their activities are also modifying natural ecosystems over an increasingly larger area of earth's surface by extensive deforestation, faulty agricultural practices, intensive grazing etc. while the universally distributed poisons like pesticides tend to depress the photosynthetic efficiency of green plants on global scale. So when the exploitation of natural resources like forest turns in to over-exploitation, it causes the unavoidable changes in the earth.

Deforestation is a critical problem not only because it depletes a natural resource of critical importance to the people of the region that cannot be replaced overnight, but also because of its far-reaching side effects. Deforestation is a major factor contributing to a variety of other environmental problems, including desertification, soil erosion, flooding, mudslides, siltation and sedimentation, habitat destruction and species extinction, and salt and chemical degradation. It is accompanied by economic, health and social hardships brought about by people trying to live and cope with a drastically changed environment. Deforestation in Asia is caused mainly by the collection of fuel wood, commercial logging, shifting cultivation and degradation through grazing and fire. Examples of the percentages of fuel wood cut in some countries, as a percentage of each country's total, include: Bangladesh, 96 percent; Bhutan, 91 percent; Burma, 84 percent; China, 70 percent; India , 91 percent; Nepal, 88 percent; the Philippines, 77 percent; and Thailand, 89 percent. The population increase that leads to clearing forests for cultivation also leads to using forests for grazing. This destroys undergrowth and seedlings that replace mature trees cut for fuel wood and other purposes. Accidental fires, common throughout the region, also contribute to the destruction of forest resources. During fires, nutrients are lost in gases and particles of smoke, and soil nutrient availability increases with the addition of ash to soil: Often increased runoff

and erosion from bare ash-covered soils following fire. High rates of nitrification in nutrient-rich soils can stimulate loss of NO and N_2O from burned soils. Forest fires volatilize nitrogen in proportion to heat generated and organic matter consumed.

Carbon exists in Earth's atmosphere primarily as the gas carbon dioxide (CO_2). Although it is a very small part of the atmosphere overall (approximately 0.04%), it plays an important role in supporting life. Other gases containing carbon in the atmosphere are methane and chlorofluorocarbons (the latter are entirely artificial). These are all greenhouse gases whose concentration in the atmosphere has been increasing in recent decades, contributing to global warming, because carbon dioxide is responsible for about 63% of disturbances in heat exchange between the Earth and its surroundings. Global warming is the basis for all the climatic changes expected. Atmospheric CO_2 concentrations rose from 288 ppmv in 1850 to 369.5 ppmv in 2000, for an increase of 81.5 ppmv. Forests help regulate the amount of carbon dioxide atmosphere. In the Amazon rain forest, the trees are getting bigger and there is a net take up of 5000 kg of carbon per hectare per year. As forests are cleared, not only is the Earth's ability to absorb carbon reduced, but the carbon retained in the trees is also released into the atmosphere. It is said that increasing the amount of in CO_2 the atmosphere will lead to increased global warming and many computer models have been constructed giving a rise in average atmospheric temperature of between 2 and 6 degrees centigrade by the end of the century i.e. by 2100. This paper discusses the consequences of the anthropogenic activities on forest ecosystem and the effects of deforestation on environmental pollution control with special reference to carbon dioxide.

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TII–10 ORCHID DIVERSITY IN ARUNACHAL PRADESH - AN UP-TO-DATE ANALYSIS WITH NOTES ON ENDEMIC, ENDANGERED SPECIES AND CONSERVATION MEASURES

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Arunachal Pradesh.

Arunachal Pradesh, one of the eight states of N.E. India, is situated between 26º 28' - 29º 31' N and 91º 30' - 97º 30' E and stretches over an area of 83,743 sq.km of which 51,540 sq.km is under forest cover, comprising diverse vegetational types of tropical, subtropical, temperate and alpine, extending from the foothills to snow-clad mountains.

The vast stretch of its forest cover at different climatic zones, together with heavy rainfall of both Southwest and Northwest monsoons and high realtive humidity, favours the state to hold the top position in the country for having maximum number of Orchid species in the wild.

A critical study based on several field explorations, literature survey and consultation of regional herbaria

has revealed that, out of about 1200 species of orchids that are so far reported from India, 558 species belonging to 139 genera are found in Arunachal Pradesh. Among the 558 species, 372 species are epiphytes while 163 are terrestrials, 21 are saprophytes and 2 are lithophytes. Among the 139 genera reported so far from the state, 72 are epiphytic, 51 are terrestrial, 9 are saprophytic while 7 genera (eg. *Cymbidium, Liparis, Cheirostylis, Eulophia* etc.) are found to have 2 or 3 types viz. terrestrial and epiphytic or saprophytic or lithophytic species.

So far from Arunachal Pradesh, 1 new genus (*India* Nageswara Rao), 35 new species, 2 new varieties and 1 new natural hybrid are reported. Further, it may be mentioned that, out of 14 monotypic genera recorded from N.E. India, maximum number of i.e. 10 genera viz. *Acrochaena, Anthogonium, Arundina, Bulleyia, Eriodes, Herpysma, Hygrochilus, India, Neogyna* and *Stereosandra* are reported from Arunachal Pradesh.

Among the larger genera, the first two positions are occupied by *Bulbophyllum* (44 spp.) and *Dendrobium* (43 spp.) among epiphytes; *Calanthe* (18 spp.) and *Goodyera* (13 spp.) among terrestrials; *Epipogium* (6 spp.) and *Galeola* (3 spp.) among saprophytes and *Cymbidium* (20 spp.) and *Liparis* (19 spp.) among mixed genera.

Out of 558 orchids reported from Arunachal Pradesh, 35 species, 2 varieties and 1 natural hybrid are strictly endemic to the state alone.

Classification of orchid genera, various threats that are responsible for the depletion of orchid populations in the wild habitats, endangered orchid species of Arunachal Pradesh and various conservation measures so far taken by the State Forest Research Institute and future programmes are detail in the paper.

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TII–11 SEED GERMINATION, SEED PREDATION AND SEEDLING RECRUITMENT IN *NOTHAPODYTES NIMMONIANA*, AN ENDANGERED SPECIES OF WESTERN GHATS

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Nothapodytes nimmoniana (Icacinaceae) is an endangered species of medicinal value. It is a medium-sized tree growing in dry-deciduous to evergreen forests of the Western Ghats. The primary aim of this study is to identify reproductive and regeneration dynamics of *Nothapodytes nimmoniana* and to develop strategies to mitigate the constraints. Two populations of *N. nimmoniana* at Biligiri Rangaswamy Temple Wildlife Sanctuary (BRTWLS), Karnataka were studied to understand the seed viability, germination, and recruitment pattern. Seed viability and germination carried out in the nursery and under field conditions. Under nursery conditions >70% seeds germinated. Different treatments were tested for viability. Under field conditions, seeds retained viability for six months and 60% germinated. Under laboratory conditions viability decreased to 5%.

To study the regeneration ecology of the species 20m x 20m plots were established. Important Value Index (IVI) for *N. nimmoniana* at Site 1 was 42.29 indicating it is dominant in that population and at Site 2

was co-dominant with IVI 15.57. 30m x 30m permanent plots were established to study the spatial patterns of all N.nimmoniana individuals. Pre and post monsoon census was conducted. Mortality of seedlings was observed in both populations and new recruits were seen in post monsoon observations. Seed predation studies were carried out during 2004 and 2005. Sixteen seeds were provisioned in plots of $0.5m^2$ under each tree (N=6). Over 80% of the seeds were predated by possibly by ants and small insects in the first year. In 2^{nd} year study, so far (90 days observation) 34% of seeds in site 1, and 38% of seeds in site 2 have been predated by rodents or squirrels. In a comparative study in Joida, Karnataka (37 days of observation) 27% of seeds have been predated. Preliminary results show that no constraints have been observed in regeneration or recruitment in *N.nimmoniana* in the study site.

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TII–12 PLANT BIODIVERSITY EXISTENCE WITH EXTINCTION IN SIRUMALAI HILLS OF EASTERN GHATS, SOUTH INDIA

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Identification, documentation and assessment of rare, threatened and endemic species are important for the conservation of natural biodiversity. The Indian region presents an immense variety of climatic and altitudinal zones and is floristically rich with 34 per cent of endemism (Chatterjee, 1940). Among 18 hot spots of the world, two major hot spots are in india, i.e, Western Ghats and Eastern Himalayas. Out of 5500 flowering plants in Southern Peninsular India 2000 flowering plants have been estimated as endemic species. The high degree of endemism in this region has conferred on them the hot spot status (Nayar, 1996). Some endemic species are restricted to very small areas or with in very limited range of distribution. Only little attention is given on the study of narrow habitat range of plants and the conservation of their genetic resources. The study of eco-distribution and spatial distribution of rare species and their location, degree of ecological gradients, climatic tolerance, adaptation, pollination biology, phenology, seed dispersal strategies and viability for rare and endangered species should also be established. The vegetation analyses of the Sirumalai hills in different forest sites were made based on stratified random sampling method (Champion and Seth, 1968) for the study of endemic plant diversity. Of the 66 endemic plant species spread over 23 families, 51 species showed seven per cent of endemism. A high degree of endemism was noted in the scrub forest (7.4%) and was followed by the mixed deciduous forest (6.1%). The number of endemic species is greater in the climax forests than in the other forests, thereby accounting for the high number (20) of endemic species in mixed deciduous forests. The ecological niches could attribute the low degree of endemism (0.7%) in the semi-evergreen forests, Among the 66 species of endemic plants of Sirumalai hills, herbs have shown highest number of endemism (49) followed by shrubs (10) and trees (7). The high degree of endemic herbs has shown to prevail in drier *climatic* conditions.in. most of the months that were brought out by rainfall. Only few species

such as *Amlrographis lineata, Entada pursaetha, Gymnema elegans* and *Knoxia sumatrensis* exhibit their presence in two or more type of forests. It is prudent to consider these areas of narrow endemics as micro centers of endemism for preserving the interesting flora. The Western Ghat endemic species, *Lobelia nicotianifolia* is frequently distributed in high altitude valleys of Sirumali hills. Many narrow endemic species like *Ampelocissus araneosa, Andrographis lineata, Decaschistia crotonifoUa, Osbeckia stellata, Tylophora mo/lissima* and *PeperQmia dindygulensis* were noted in the southern side of mixed deciduous forests. The results showed that the endemic category of Sirumalais is a diverse assemblage of herbs. Tree genera are poorly represented in the endemic category in this region. Extinction of plant species may be due to environmental factors, ecological substitutions, biological causes and human interference like overexploitation for medicinal, fibre, fuel and other purposes. Some of the endemic species of the hills have been used by the local people for medicinal purposes. The species like *Decalepis hamiltonii, Entada pursaetha, Mucuna pruriens* and *Andrographis lineata* have also been collected largely by tribals for additional income and local use, Sirumalais has wild rice, wild bean and banana varieties that are not reported elsewhere are extremely significant genetic recourses whose habitats deserve protection.

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TII–13 A STUDY ON THE DISTRIBUTION PATTERN OF ENDEMIC SPECIES OF WESTERN GHATS, SOUTHERN INDIA

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The Western Ghats is one of the hot-spots of the world and harboring 4780 species of angiosperms; out of which 2180 are considered as endemics .These plants are found in different ecological niches of Western Ghats. The habitat destruction has taken place due to commercial agriculture, man-made plantations, hydropower, mining and a biotic pressure in the forest ecosystems and it has resulted in the fragmentation of habitats and some of the species have disappeared from the wild. The perusal of literature reveals that at least 475 species were reported as rare, threatened and endangered category. The botanist, who have been working in this area more than twenty years has resulted in the collection of more than 40 (forty) species of endemic plants; out of which 25 (twenty five) plants were rediscovered and their known range of distribution across the Western Ghats are highlighted in this paper. The present study suggests that there is an urgent need for both intensive and extensive explorations has to be carried out in the rich endemic areas of Western Ghats and in turn it will throw more light on the distribution pattern of these endemic plants .Based on the field studies suitable conservation strategies can be initiated.

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TII–14 GRASS GENETIC RESOURCES OF SOUTHERN WESTERN GHATS, INDIA

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Grass crops form the source of many food chains and provides 80% of World's food. It is estimated that in addition to the above at least 300 grass species are known to be harvested in the wild as cereals. Hindustan centre is one of the twelve centres of mega diversity of plant genetic resources which has contributed significantly to the world's plant genetic resources. The Peninsular India forms the important genetic resource centre for many grass crops which includes cereals, millets, sugarcane, lemon grass, ginger grass etc. More than 80% of the grass-crop relatives represented in Peninsular India, which include many of the endemic species, occur in Western Ghats of India especially in the Southern Western Ghats region.

Surveying and inventorying the plant genetic resources is one of the primary activity of the global plan of action for the conservation and sustainable utilization of plant genetic resources for food and agriculture (Leipzig Declaration, 1996). It is found that 3 cereals (rice, wheat, maize), 3 millets (bajra, ragi, italian millet), 2 *Cymbopogon* sp. and sugarcane are known to be cultivated in Southern Western Ghat region as major grass crops. In addition to the above, there are 11 cereals cultivated as minor crops. Details of about 50 wild relatives of relevant grass crops in Southern western Ghat region are documented here. The present poster also highlights a brief account of distribution, endemism and recommendations on conservation measures to be taken on these valuable grass genetic resources.

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TII–15 STATUS AND CONSERVATION OF SOME THREATENED PLANT BIODIVERSITY OF ARID KACHCHH, GUJARAT, INDIA.

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Biodiversity refers to variety and variability of life extending form genes to species to ecosystems. Kachchh, the second largest district in India and located at the western end of Gujarat state is arid in nature and fall under the Desert province of the Indian Bio-geographic zone. It is endowed with many ecosystems ranging from desert thorn forests, scrub savannah, grassland and the most unique Rann system (Saline desert) and arid agro-ecosystem, thus adding more uniqueness to the biodiversity of the State as well as the country.

Most of these ecosystems and the bio-wealth are faced with increasing anthropogenic pressure and natural threats. Increasing human abuse to arid ecosystems due to sparse and low vegetation cover and lack of ecological entity causes depletion of arid biodiversity in their natural habitats, which has pushed many species towards rarity. Thus it becomes more imperative to conserve these threatened species, which are already at the brink of extinction. This paper discuss the status, distribution, threats faced and the conservation implications of some of the threatened plant species of the arid Kachchh district studied during 1998 to 2001.

Kachchh district ( ) extending to 45,652 sq km, though faced with extreme climatic condition from very hot weather in summer with maximum temperatures ranging from 39 to 45°C, cold in winter (min 2°C) and frequent draughts with normal rains once in two to three years, which averages to 326mm. All these have resulted in unique type of habitats varying from the last remnants of southern tropical thorn forest, large extent of grasslands, mangroves forest and mud flats along the coast, agro-ecosystems, seasonal wetlands and the most unique Rann system (Saline desert) with its beyts (small elevated portion of land). These habitats or system have been home for several species of plants and many of them being rare due to both natural and anthropogenic reasons.

Nineteen plant species listed as threatened by WCMC or National Red Data Book was studied. The status survey of the plants was carried out in the areas where it was said to be present based on literature and secondary information. Further other ecosystems or habitats adjoining to these earlier reported sites were also surveyed. Belt transects and circular plots were used to enumerate each species. Information on the macro habitat and the threats faced were recorded.

The 19 species studied includes eight herbs, five shrubs and six climbers or runners. Among these, six species, *Ammania desertorum, Carollocarpus conocarpus, Dactyliandra welwitschii, Limonium stocksii, Pavonia ceratocarpa* and *Schweinfurthia papilionacea* were found to be highly threatened due to it very low number (<500 individuals) and presence in very few sites (<three sites) and macro habitats (< three sites). Seven species, like *Campylanthus ramosissimus, Dipcadi erythream, Ephedra foliate, Heliotropium bacciferum var. suberosum, Indigofera caerulea var. monosperma, Ipomoea kotschyana* and *Tribulis rajasthanensis* were moderately threatened, which were with either >500 to 1500 individuals or found in 4-<6 macro habitats or 11-20 locations. Six species (*Citrullus colocynthis, Commiphora wightii, Convolvulus stocksii, Helichrysum cutchicum, Heliotropium rariflorum and Sida tiagii*) were found to be less threatened as they were represented by more than 1500 individuals and distributed in more that 20 location and more than six macro habitats.

Within these species, *Carollocarpus conocarpus* and *Ammania desertorum* reported very low numbers (7 and 16 individuals) and also had highly restricted distribution (three and two locations). *Commiphora wightii, and Helichrysum cutchicum* showed wider distribution (75 and 40 locations) and healthy abundance status (9774 and 6586 individuals). *Ammania desertorum, Dactyliandra welwitschii, Limonium stocksii and Schweinfurthia papilionacea* were highly restricted to single habitat like wetland (village pond), agro-ecosystem (hedges of agricultural lands), coast (dunes) and open scrub habitats respectively.

Over grazing, habitat loss due encroachment for agriculture, industrial development and mining seems to be the major threats faced by most (15) of the species. Intensive survey to identify threatened biodiversity hotspot is of high priority. So these hotspots can be protected and managed as part of *in-situ* conservation with the involvement of local community. Further, species with low to moderate number and restricted distribution must be propagated in botanical gardens as part of ex-situ conservation.

TECHNICAL SESSION - III

MEDICINAL / AROMATIC / ECONOMIC PLANTS AND ITS SUSTAINABLE UTILIZATION

TIII–01 DECCAN INDIAN MEDICINAL PLANTS – TRADITIONAL KNOWLEDGE, TRADE, THREATS AND CONSERVATION CONCERNS

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Conservation of plant resources is of a global concern because we don't know what we are losing and what we will need in future. It has developed an increasing interest in number of wild species, which are medicinally, industrially and agriculturally important. According to WHO report, over 80% of the world population relies on traditional medicine, largely plant based for their primary healthcare needs. India has 15 Agroclimatic zones, 12 ecoregions and 47,000 plant sp. and is one of the 12 mega biodiversity centres. The Indian Systems of Medicine have identified 1500 medicinal plants, of which 500 species are used in the preparation of commercial drugs. These medicinal plants contribute to 80% of the raw materials used in the preparation of drugs. Andhra Pradesh shows a wide range of ecological amplitude.Around 2531 plant sps are reported.

Tribal and rural people in Deccan ecoregion have the rich information about plant wealth for human health (Hemadri, 1994). This traditional knowledge is the basis for contemporary drug discovery strategies. Very a few medicinal plants can be cultivated on large scale and most of the raw material required is often collected from the wild habitat. Therefore, there is an enormous pressure on these plant resources. In this context, sustainable utilization and conservation are crucial. We have initiated the *ex situ* conservation of redlisted medicinal plants of Deccan ecoregion in 2000 and research is progressing In 1999, the Ministry of Environment and Forests, Government of Idida evolved the National Biodiversity Strategy and Action Plan (NBSAP) which emphasized the strategies and needed for conservation and sustainable use of biological diversity of 12 recognized ecoregions 1. Deccan Plateau (Andhra Pradesh, part of Maharashtra, Karnataka, Tamil Nadu and Kerala), 2. Vindhya-Satpura range, 3.West Himalaya, 4. Shivaliks, 5. Aravalli range, 6. Gangetic Plains, 7. North-East India, 8. Central forest belt, 9. Eastern Ghats, 10. West Coast, 11. EastCoast,12,WesternGhats Boundaries for the Deccan Plateau: North= Narmada river, South = Cauvery river, East = Coromandel coast (excluding eastern ghats); West = Western ghats) (Please see cited references).

Plants used in traditional medicine in Andhra Pradesh (Latin name, teluguname and family)

Achyranthes aspera L. **Utthareni- Amaranthaceae**

Actinopteris radiata (Sw.) Link **Mayurasikhi- Actinynopteridaceae**

Alangium salviifolium (L.) Wang **Uduga- Alangiaceae**

Alstonia scholaris (L.) R.Br **Edakuka pala- Apocynaceae**

Andrographis paniculata (Burm.f.) Wall. ex. Nees **Nela vemu- Acanthaceae**

Argyreia nervosa (Burm.f) Boj. **Samudrapala- Convolvulaceae**

Aristolochia bracteolate Lam. **Gadidagadapaku- Aristolochiaceae**

Aristolochia indica L. **Nalla eshwari- Aristolochiaceae**

*Asparagus racemosu*s Willd. **Satavari- Liliaceae**

Balanites aegyptiaca (L.) Del **Garakayalu- Zygophyllaceae**

Barringtonia acutangula (L.) Gaertn **Kadapa chettu- Barringtoniaceae**

Butea monosperma (Lam.) Taub. **Moduga theegalu - Fabaceae**

Butea superba Roxb. **Theega moduga - Fabaceae**

Calotropis procera (Ait) R. Br. **Gilledu- Asclepiadaceae**

Cardiospermum halicacabum L. **Butta theega- Sapindaceae**

Cassia fistula L. **Rela- Caesalpiniaceae**

Cassia holosericea Fresen **Nelathangadi- Caesalpiniaceae**

Centella asiatica (L.) Urb. **Saraswati aku- Apiaceae**

Citrullus colocynthis (L.) Schard **Pedda papara- Cucurbitaceae**

Clerodendrum serratum (L.) Moon **Bommala marri- Verbenaceae**

Coccinia grandis (L.) Voigt **Thondaku- Cucurbitaceae**

Costus speciosus (Koen.) Sm. **Kevu kanda- Zingiberaceae**

Crataeva roxburghii Wt. et Arn **Ramajogi chettu- Capparidaceae**

Crotalaria verrucosa L. **Thella eswari- Fabaceae**

Curculigo orchioides Gaertn. **Nelathati gaddalu- Amaryllidaceae**

Cycas circinalis L. **Arum- Cycadaceae**

Decalepis hamiltonii Wt. et. Arn **Maradi gaddalu- Asclepiadaceae**

Dichrostachys cinerea (L.) Wt.et. Arn. **Velthuru chettu- Mimosaceae**

Dregea volubilis (L.f) Benth ex. Hook.f. **Thummidi theega- Asclepiadaceae**

Elephantopus scaber L. **Kukkurumuthu / Eddadugu- Asteraceae**

Embelia sp. (R&S) A.DC **Konda pulleru- Myrsinaceae**

*Enicostema hyssopifoliu*m (Willd).I.C.Verdoorn **Nela gorimidi- Gentianaceae**

Erythroxylum monogynum Roxb. **Kanaragandham./ Devadari- Erythroxylaceae**

*Gloriosa superb*a L. **Rayerudumpa theega / Pottidumpa- Liliaceae**

Gymnema sylvestre (Retz) R.Br ex Schu. **Puttabhadra- Asclepiadaceae**

Helicteres isora L. **Nulikaya- Sterculiaceae**

Hemionitis arifolia (Burm,) Moore **Ramabhanum- Hemionitidaceae**

Hesperethusa crenulata (L.) Del **Thorri elaka- Rutaceae**

Leonotis nepetifolia (L.) Ait.f. **Sirinta- Lamiaceae**

Lepidagathis hamiltoniana Wall. **Nakkapithiri gadda- Acanthaceae**

Marsilea minuta L.**Arekuraku- Marsileaceae**

Martynia annua L. **Mandrakppa kaya mokka- Martyniaceae**

Mucuna purienesis (L.) DC **Duradagunta / Dulagondi- Fabaceae**

Oroxylum indicum (L) Vent **Rachapampini- Bignoniaceae**

Pongamia pinnta (L.) Pierre **Kanuga- Fabaceae**

Pygmaeopremna herbacea (Roxb.) Moldnk. **Gantu bharangi- Verbenaceae**

Rauvolfia serpentine (Linn.) Benth ex. Kurz **Sarpagandha- Apocynaceae**

Schleichera oleosa (Lour) Oken. **Busi- Sapindaceae**

Semecarpus anacardium L. F. **Jeedi- Anacardiaceae**

Sida cordifolia L. **Bala- Malvaceae**

*Solanum surattens*e Burm. f. **Peddamulaka- Solanaceae**

Soymida febrifuga (Roxb.) A.Juss. **Somi / Rohini- Meliaceae**

Stereopsermum suaveolens (Roxb.) DC **Kaligottu/ Padiri- Bignoniaceae**

Tephrosia purpurea (L.)Pers. **Vempali- Fabaceae**

Terminalia tomentosa (Roxb. Ex. DC) Wt.et Arn. **Nallamaddi- Combretaceae**

Tinospora cordifolia (Willd) Miers ex. Hook f. et Th **Thippathhega- Menispermaceae**

Tylophorai indica (Burm.f.)Merr **Mekameyani aku- Asclepiadaceae**

Urginea nagarjunae Hemadri & Swahari **Nagarjuna ulligadda- Liliaceae**

Vanda tessellata Lodd.ex Loud. **Elkum- Orchidaceae**

Vitex negundo L. **Vavili- Verbenaceae**

Withania somnifera (L.) Dunal **Ashwagandha- Solanaceae**

Zanthoxylum alatum Roxb. **Ranabelli- Rutaceae**

Impediments to biodiversity conservation are also discussed

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TIII–02 DIVERSITY AND CONSERVATION OF MEDICNAL PLANTS IN GUJARAT

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The state of Gujarat is endowed with 8 agro- climatic zones corresponding with wide variation in climate, edaphic and floristic composition. The general pattern of vegetation consist of tropical dry deciduous forest, tropical dry (mixed) deciduous forest, tropical dry evergreen forest, tropical thorn forest, littoral and swamp forest disturbed in the different region. The total notified forest area is about 10% of the geographical area of the state. The state harbour more than 4300 plant species that is 10% of the documented floral diversity of the country. Of these, 1315 species are medicinal and consists of 16% of the medicinal plants of the country(i.e.8000) distributed over 6 zones namely south Gujarat, South East Gujarat, Gujarat central, North Gujarat, Saurashtra and Kachchh. Occurrence of medicinal plant species is the highest in central Gujarat followed by South East Gujarat, Saurashtra, South Gujarat, North Gujarat, and Kachchh respectively. 102 species require special conservation efforts to mitigate habitat losses and anthropogenic factors. Central Gujarat has the highest conservation species followed by South Gujarat, South East Gujarat, Saurashtra, North Gujarat, and Kachchh respectively. Besides these,, 76 species naturally rare in the state, which need recognition, special care, protection and monitoring. South Gujarat zone has the highest naturally rare species which is followed by South East Gujarat, Central Gujarat, Saurashtra, Kachchh and North Gujarat zone. In Gujarat, 18 " Negative species" were found out of 114 listed in India, which needs control and regulate the harvesting of these species have been found to be endemic to India out of 1315 medicinal plants of the state. 8.7% of the total geographical areas are protected under the wildlife sanctuaries or national parks of the state which is more than double the national average of 4% of protected areas.

There have been various efforts of the propagation and conservation of medicinal plants in state by various Government departments, Organization, Institution and Universities. To promote the use of medicinal plants and meet the demand of raw material for Government owned herbal industry (GOHI), the health department is currently maintaining nine gardens at different locations of the state. Under state forest department *ex-situ* conservation of medicinal plants has been working in the form Ayurvedic gardens, Vanaspati Van project, Joint Forest Management Programme and Social Forestry Programme. *In situ* conservation of medicinal plants has been done in reserved forests, protected areas (wildlife sanctuaries or national parks) of the state. Besides these efforts, Gujarat Medicinal Plant Board (GMPB) and different NGO's are also actively working to conserve the medicinal plants. National Research Centre on Medicinal and Aromatic Plant (NRCMAP), Govt. Botanical Garden, Waghai (Dangs), Gujarat Institute of Desert Ecology (GUIDE) and ASPEE College of Horticulture and Forestry, N.A.U., Navasari, are some of the few organizations which are actively engaged in promotion and conservation of different medicinal plants of the state.

TIII–03 AN ETHNOBOTANICAL SURVEY OF CLIMBERS REPORTED FROM NIMAR REGION OF MADHYA PRADESH

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The present communication deals with an ethnobotanical survey of climbing (Twiners, creepers, climber proper and hook climbers) plants reported from Nimar region (21o 05' to 22o 25' N Latitude, 74o 58' to 78o 14' E Longitude and 277 m asl) during the year 2004-2005. Nimar region includes two districts namely Khandwa (East Nimar) and Khargone (West Nimar). Burhanpur and Barwani newly formed districts that are recently separated from Nimar region are not included under the present survey. The total area of Nimar region is 18983 Sq km, out of which 7332 Sq Km is covered by forests. The average annual precipitation is 770 mm while maximum and minimum temperatures are 42.7o C and 11.2o C respectively. The flora and fauna of this tract are quite rich and its detailed survey is yet to be done. There is much scope of doing research work in this tribal area.

In an earlier study 93 taxa belonging to 66 genera and 30 angiospermic families were recorded by the present author. In the recent survey it has been reported that 31 taxa belonging to 26 families are used by the tribal people of Nimar region to cure various human ailments. Important climbers collected in this connection are mentioned here: *Abrus precatorius, Aristolochia bracteata, Asparagus racemosus, Boerhaavia diffusa, Bryonia dioica, Bryonopsis laciniosa, Cardiospermum helicacabum, Cissus quadrangularis, Citrullus colocynths, Clerodendron inerme, Clitoria ternatea, Cocculus hirsutus, Cuscuta reflexa, Gloriosa superba, Gymnema sylvestris, Hemedesmus indicus, Luffa acutangula, Momordica dioica, Mucuna pruriens, Oxalis corniculata, Passiflora foetida, Pergularia daemia, Solanum surattense* and *Tinospora cordifolia.* Further work in this connection is in progress.

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TIII–04 ELECTRONIC LABELS FOR HERBAL MEDICINAL PRODUCTS

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Two recently reported incidences-one in international media; the other in national media-have necessitated a through introspection to the need of proving appropriate labels to herbal medicinal products launched in the market. In recent investigations, researchers reported detection of heavy metals like lead, mercury and arsenic in ayurvedic products. Concentrations of heavy metals in some herbal medicines were as high as hundreds and thousands of time the maximum permissible limits. In another incidence, herbal medicines claimed to be using only forest and farm based vegetarian constituents were reported to contain animal/human residues.

Without authentic labels that display the essential information on the products, the consumers, medical practitioners and drug regulatory authorities are kept uninformed about the drug safety and effectiveness. In continuing efforts to use modern information technology to help the health care providers and to further improve patient safety, the electronic labels have exhibited a great potential to easily access the product information.

The paper presents and discusses the use of new electronic labels. Essential of passive and active electronic labels and read-only and read/write labels are presented. Postings on web sites are suggested.

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TIII–05 BIODIVERSITY OF AMF IN THE MEDICINAL PLANTS FOUND IN WILD HABITATION IN ARAVALI RANGE (DIST. GURGAON), HARYANA, INOCULATION OF THE MED. PLANTS AND COMPARATIVE PHYTOCHEMICAL STUDIES.

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Ayurveda, the Science of Life is the oldest, ancient, time tested and yet very systematic and very scientific system of medicine not only for humans but also for animals and plants. There is the globalization of Ayurveda and the world scenario is changing very fast in using the traditional systems of medicine in health care which are all plant based. The world market trade in the medicinal plants is estimated to be approx. Rs. 66,000 crores (2002 data) which is increasing @ 15-20% every year and Indian contribution in the trade has not even touched 1%. China has taken a lead 20 years ago in capturing the world market. The medicinal plants are being harvested from the wild since ancient times. 80% demand of the Ayurvedic and other systems of medicine based pharmacies is met from the forests. To meet the rising world and domestic market, these have to be cultivated at the farmer's fields where only organic methods have to be used. VAM/AMF are phyto symbioant and are found to have association in more than 90% of the families of the plants found on the Mother Earth including the medicinal plants. The use of VAM as a biofertilizer is gaining popularity in the cultivation of cane sugar and vegetables and can be successfully used in the cultivation of medicinal plants also. Aravali Range of Mountains are the oldest mountain ranges in the subtropical area of North and are the store house of a variety of medicinal plants.We have started our search for the biodiversity of AMF in the medicinal plants found in the Aravali Ranges inn Distt. Gurgaon under the NMPB sponsored Research Project. The soil samples were collected from the rhizosphere of various medicinal plants found in the foress and the spores were separated by wet and sieving methods and identified at the genera level. (The spores were identified by Dr. Reena Singh,Mycorrhiza Research Centre, TERI,New Delhi). Trap cultures were also maintained to completely scan the mycorrhizal spores. They mainly belong to Glomus, Gigaspora, Scutellospora genera. The spores will be multiplied by root organ cultures and the inoculum will be used for the organic cultivation of medicinal plants by inoculating the specific med . plants with specific spores.

A no. of medicinal plants viz.Bacopa monieri, Centella asiatica, Asparagus racemosus(White and yellow), Cholorophytum borivillianum,Ocimum sanctum,O.basilicum, O.gratissimum(Cloccimum,OC-14), O.canum(OC-12), Aclypha indica, Aloe vera, Cassia occidentalis, Cassia tora, Tylophora indica, Plantago major , Garlic ,Onion, Acacia concinna,Solanum nigerum , Silybum marianum. In all the cases, the inoculated plants had the higher biomass, more no. of branching, showed early flowering, more no. of seed pods per plant.In case of Clitoria ternetea, we observed a very interesting observation. The plants which were obtained from the seeds of the mycorrhized plants were having the size of the leaves practically 1.5t more than those obtained from the nonmycorrhized plants. The seeds of the mycorrhized Silybum marianum were found to be dark black while the nonmycorrhized plants were having the usual patches. The HPLC profile of the mycorrhized Chlorophytum borivillianum was significantly different from the control plants. The extensive critical analsis is under way to know about the new components that are produced as a result of the mycorrhiza inoculation. The observations for the third progenies are under observations. The yield of the biomass, root biomass, the weight of the stems and the oil contents in the case of the ocimum cultivars was also found to be more in the case of the mycorrhized plants. However, when the active principals were estimated using HPLC/HPTLC methods, the concentration of the active ingredients remained the same per unit mass of the planting.

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TIII–06 CONSERVATION OF MEDICINAL PLANTS FOR THEIR SUSTAINABILITY: CHALLENGES AND STRATEGIES FOR IMPROVEMENT

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Hundreds of millions of people mostly in developing countries derive a significant part of their sustenance needs and income from gathered plant and animal products. Gathering of medicinal plants also continues in developed countries for economic and cultural reasons. Among these uses, medicinal plants play a central role, not only as traditional medicines used in many cultures, but also as trade commodities which meet the demand of often distant markets. The developed countries are showing rising interest in Indian herbal products in food supplements (Neutraceuticals), cosmetics and intermediates. Several ingredients in Indian plants are being investigated abroad and have found application in many allopathic drugs (phytopharmaceuticals) manufactured for treatments on cancer, AIDS, blood pressure, heart diseases, diabetes, etc., In this ways, medicinal plants are an essential part of traditional health care systems. In this regard, India is a veritable treasure chest of valuable plants including the medicinal plants.

Medicinal plants biodiversity is increasingly threatened by various environmental, socioeconomic and institutional problems. The problem is in various dimensions, starting from the unavailability of several medical manuscripts, through afforestation, over-exploitation, habitat loss, over population, urbanization, drastic climate

change, commercialisation and other major issues. Set back arises by the non-availability of clear cut validation is available, though there is great number of plants having the healing power of ailments and also due to the adulteration of raw as well as processed drugs prepared from medicinal plants.

Forest conservation, controlled gathering of medicinal plants and its parts from the natural habitat, adoption of proper cultivation technique, awareness creation on medicinal plants biodiversity, sustainable harvesting procedure, promoting conservation of medicinal plants especially critically endangered medicinal plants, intactness of scared groves, germplasm conservation, curriculum development on medicinal plants utilization and conservation, cultivating and post-harvesting and processing techniques for proper validation of medicinal plants at various levels of study, encouraging cultivation of medicinal plants through establishing proper buy-back systems, sustainable marketability, secondary metabolites production through cell culture for medicine extraction, when such medicinally valued plants become under severe threat in its extinction, effective land-use management, institutional development, knowledge sharing, documentation and dissemination, law and enforcement, people's participation, abiding by national and international conventions and treaties, formation of stronger group among tribal community, farmers, planters, end-users of medicinal plants, researchers, institutions, managers, organizations, government agencies, policy makers, environmentalists, socio-economic analysts and other relevant personnel have to join together to make the efforts for keeping medicinal plants biodiversity as a viable and sustainable.

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TIII–07 SCREENING OF NATURAL DYE YIELDING PLANTS IN SHAHJAHANPUR DISTRICT UTTAR PRADESH

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Dyes are plant products which have been attracting human beings, since pre-historic time. Dyes have bright fascinating colours in nature giving us pleasent feeling. With the advent of synthetic dyes, natural dyes have lost their significance.

Since synthetic dyes have carcinogenic properties therefore, a renewed interest is developed for natural dyes. The chief source of neutral dye is in textile industry, besides they are used in dyeing hair, wall painting, to colour nail and skin & also colouring toys, leather, silk & food-stuffs. The present study is carried out to screen the plants for natural dyes in Shahjahanpur district. 16 dye yielding plants were screened for their potential Different parts of plant yield dye. eg- Bark (*Acacia nilotica, Cassia fistula, Zizyphus mauritiona, Ficus bengalensis, Psydium guajava*) Leaves (*Lawsonia enermis, Tamarindus indica*), Flower (*Butea monosprma*) Fruit (*Syzygium cumini, Punica granatum, Aegle marmelos, Bosella alba, Emblica officinalis*), Scales of bulb (*Allium cepa*), whole plant (*Eclipta prostrata*) , pedicel (*Nyctanthes arportristis*)

Natural dyes are extracted after boiling the plant part with distilled water at 100^0c temp for 2 hours. It is then centrifuged to eliminate the debris, the supernatant is used as dye.

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TIII–08 APPROACHES TOWARDS LOW COST CROP HARVESTING TECHNOLOGIES IN RUBBER (*HEVEA BRASILIENSIS*)

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Though India is fourth in natural rubber (NR) production among the major rubber producing countries, our productivity is highest in the world (1705 Kg/ha/year). In India, cost of production is very high due to topography, agro climate and cultural operations. Tapping alone accounts for more than 50% of the cost of production. Reduction in cost of production by adopting low frequency tapping (LFT) with judicious stimulation (Ethephon) is one of the approaches.

An experiment was conducted on low frequency tapping over a period of eight years under third daily (d/3), fourth daily (d/4) and weekly (d/7) frequencies of tapping of half spiral cuts with different frequencies of ethephon application. Unstimulated trees under alternate daily tapping (d/2) served as control. Cumulative and mean yield obtained under low frequency tapping is comparable to that of alternate daily tapping. There was no drastic variation in dry rubber content under low frequency tapping. Regular tapping and use of rainguarding is essential for the success of low frequency tapping. Low frequency tapping including weekly tapping is successfully extended, popularized and widely adopted in more than 20,000 ha in India.

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TIII–09 DISTRIBUTION AND ECOLOGY OF AN ENDEMIC MEDICINAL PLANT, *GAULTHERIA FRAGRANTISSIMA* WALLICH IN NILGIRIS

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The plant species, *Gaultheria fragrantissima* Wallich, a medicinal shrub used to extract the winter green oil is distributed in the high hills of Nilgiris at shola margins. Its ecological characters are varied significantly across the sholas. Its ecological importance is found to be characteristic at the margins of Ebbenadu, Kothagiri terrace and Kodappamand sholas. Further, correlation analysis between the population size and certain environmental variables shows that the sholas with more than 9 hrs light period in a day at their margins are more suitable for growth and establishment of *Gaultheria fragrantissima*. Hence, to conserve the wild and genetic stocks, cultivation of *Gaultheria fragrantissima* at shola margins in Nilgiris where the light duration is more than 9 hrs per day is suggested.

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TIII–10 A STUDY ON MEDICINAL PLANTS AND POSSIBLE THREATS FOR THEIR SURVIVAL IN KAPTIPADA FOREST RANGE

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The Kaptipada forest range lies between $21^0$19' and 21^0 44' North latitude and between $86^0$23' and $86^0$42' East longitude having a total area of 478.5 sq. miles. It is considered one of the richest botanical treasures in Orissa which is now under intense biotic pressure owing to forest fire, over- exploitation of medicinal plants for drug and conversion of forest to agriculture lands. The present investigation was carried out by the intensive field explorations and interaction with the tribal people for nearly two years to identify the potential ethnomedicinal plants distributed in the Kaptipada forest range and to ascertain possible threats for its survival. During the study, 120 species belonging to 51 families were found to have the medicinal importance and were being used to cure various ailments by the local tribal people and the pharmaceutical companies. The maximum number of ethnomedicinal plants was represented by family Asteraceae, Euphorbiaceae, Fabaceae and Verbenaceae. In the survey of Ethnomedicinal plants enumeration, botanical name, family, use of different parts by specific tribes (Santal, Bathudi, Kolha, Kondha, Bhumija, Gond, Lodha etc.) and information about the diseases have been recorded. The data when crosschecked with the published literature, it was found that most of the uses were either less known or not recorded earlier. Some of the uses of medicinal plants for treatment of diseases/dis-order were identified for the first time. Few species such as ***Plumbago indica, Gmelina arborea, Abrus precatorious and Argemone maxicana*** were found to be discontinuous in distribution and presently occur only in the scheduled habitats. Those were rather becoming endangered /rare either on account of habitat loss or any other factor such as change in eco-climate, poor self-seeding and regeneration capacity etc. Plants like ***Gloriosa superaba, Pterosperum acerifolium and Tinospora cordifolia*** had been badly depleted due to over exploitation for medicinal uses. So, this study would help to conserve the potential medicinal plants for sustainable use and socio economic development of the tribal.

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TIII–11 ETHNOMEDICINAL USES OF CERTAIN PLANTS BY KORKU TRIBALS OF KHANDWA DISTRICT IN M.P. (INDIA)

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The Subject of ethnomedicine has now gained global significance. India is known for its culture and tradition, the knowledge derived from the culture is mainly intuitive and based on mystical experience of our sages. Medicinal uses of plants restricted only to tribals and villagers, so the main object of ethnomedicobotany should be to bring this knowledge out from the boundaries and spread it to whole universe.

Madhya Pradesh as an impressive biodiversity in plants due to wide variability in edaphic and climatic conditions. Madhya Pradesh is one of the states having largest percentage of scheduled tribe in population.

The Korku tribe are inhabitants of Betul, East Nimar (Khandwa and Burhanpur), Dewas, Sarguja, Chindwara, Hoshangabad and Sehore districts of M.P. They constitute the fourth largest tribe of India; the first three being Gounds, Santhals and Bhils. The large number of Korkus live in the neighbouring state Maharashtra. The Korkus are live in the villages situated in the midst of dense forest, near river or fields. Due to their natural association and dependence on forest for daily needs, they have old practice to utilise forest products for food, fodder, fibre, medicine, contraceptives, skin diseases, stomachic, anti malaria, anti fever and many other human ailments. An ethnomedicinal survey was conducted in tribal villages viz. Guri, Dhorkut, Kalibhit, Madani and Machhoundi situated 20 to 50 K.M. away from Khandwa.

Present paper deals with uses of 30 ethno-medicinal plants with their botanical names, family, vernacular name and parts used have been described. Some of the ethnomedicinal plants used widely by the Korkus are *Abrus precatorius* (Ghyghchi) used as an anti fertility, nervous disorder; *Amaranthus spinosus* (Kotaili chaulai) boiled leaves and roots are given to children as laxative; *Andrographis echioides* (Ranjimani), decoction of plants used as a tonic, stomachic, dysentery; *Aristolochia indica* (Isharmul) powder of roots given with honey for leucoderma, juice of leaves in snake-bite; *Basella rubra* (Poi) juice of leaves used in cases of constipation particularly in children and pregnant women; *Cassia occidentalis* (Kasondi) paste of leaves and seeds used externally in skin diseases, anti periodic; *Cuscuta reflexa* (Akasbel), decoction of plants are control to fever, used externally against itch; *Tephrosia purpurea* (Sarphonka), plant used as a tonic, laxative for children, purifier of the blood; *Vitis latifolia* (Dokarbel), paste of plant powder used on swollen part of body; *Vitex negundo* (Nirgundi), leaves are dried ones smoked for relief of headache and catarrhal etc.

There is no recent study or data regarding Ethnobotanical, Ethno medicinal, Ethnoveterinary and Ethnoreligious plants used by Korku tribe of (East Nimar) Khandwa district. Nowadays, study of ethnomedicinal plants are much essential for human health.

TIII–12 BIODIVERSITY OF CASHEW IN INDIA

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Cashew nut (*Anacardium occidentale* L.) is the most important plantation crop of India. Cashew crop, a native of Brazil was introduced by the Portuguese during the 16th century A.D., which had well adopted to peninsular conditions. This evergreen tropical tree planted for soil conservation did not receive much attention until the end of the seventh five-year plan. Due to concerted research and developmental efforts during the last 25 years, cashew attained the status of one of the leading plantation crops of the country in earning substantial foreign exchange. The crop is covered in an area of 7.80 lakh hectares and the production has been increased to5.35 lakh tonnes during 2003-2004. The average productivity is 800 kg per hectare. The export is 98254 metric tonnes during 2003 and India ranked first in export.

The early attempts for cashew germplasm collection were made during the early fifties in the composite states of Madras, Travancore, Cochin and Bombay. During 1971, research schemes were initiated in cashew research. Subsequent to the establishment of National Research Centre for Cashew (NRCC) at Puttur (Karnataka) the germplasm collection being made through the vegetative propagated material. The materials are conserved in the National Cashew Gene Bank (NCGB) at National Research Centre for Cashew (NRCC) at Puttur (Karnataka) and Regional cashew Field Gene Banks (RCFGB) of nine cashew research centres across the country.

A total of 1250 germplasm accessions are being maintained at nine centers across the country (Swamy *et al* 2001). In order to safeguard our national interest in the field of plant genetic resources, national/indigenous collection numbers are being assigned by the National Bureau of Plant Genetic Resources (NBPGR), New Delhi.

Apart from export importance to this crop, it is also being cultivated in forest areas to conserve soil to maintain the ecosystem.

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TIII–13 BIODIVERSITY AND CONSERVATION OF MEDICINAL PLANTS

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Biodiversity – Overview

India with diverse agro-climatic conditions and regional topography has been considered as treasure house or botanical garden of plant genetic resources. Hence, India is recognized as one of the world's top 17 mega diversity nations. Our herbal wealth constitutes more than 8000 species and account for around 50 per cent of all higher flowering plant species of India. Around 70 per cent of the medicinal plants in the country are spread across the tropical forests of Western Ghats. However, avail-

able information shows that 1, 800 species are used in Classical Indian systems of medicines. Ayurveda uses 1,200, Siddha – 900, Unani – 700, Amchi – 600, Tibetan – 450.

Although there are around 8000 medicinal plant species used by different communities in India across different ecosystems, only around 10% of them (880 species) are in active trade. Among these, around 48 species are exported in the form of raw drugs and extracts while around 42 species are imported. The wild populations of about 100 of the traded species are known to have declined, thereby making them to be considered threatened. This is the situation of raw drug trade in India that unfolds.

Geographic distribution

The natural occurrence of traded species is another element of interest here. It is found that these species are distributed across different bio-geographic zones, diverse habitats and landscape elements. About 18% of these species are confined to Himalayan and Trans Himalayan zone including North East India while around 4% are restricted to Western Ghats and 0.5% is found only in the Desert zone. The rest of the species (around 77%) have a wide range of distribution across the other bio-geographic zones of the country.

Origin and source

Of these 880 species, nearly 538 (61%) species occur only in the wild (with no known cultivation), while 88 (10%) are recorded only under cultivation in India. However 212 species (25%) are recorded both in wild and under cultivation. The remaining 42 (4%) are not recorded in the wild or under cultivation in India and therefore inferred to be originated in other countries.

Status of these traded plants

The status of the natural populations of these plants is however not that encouraging. A Rapid Assessment of selected Medicinal plants of Peninsular India and North India for their threat status as per IUCN guidelines has revealed that the wild populations of 100 species are facing different degrees of threat.

Of these, 14 are threatened globally as these are endemic to India and deserve immediate conservation attention.

The alarming situation of the involvement of "threatened" species, in trade, is not peculiar to India alone. The Chinese Red Data Book lists 388 plant species, of which 69 are found to be in trade.

The emerging field of herbal products industry holds a great potential to the economic development of the Indian region. Usage of herbs as a source of food, medicine, fragrance, flavour, dyes and other items in Indian systems of medicine is in increasing trend. It is estimated that, 95 percent of the medicinal plants used in Indian herbal industry today are collected from wild. About half a million tones of dry material is collected through destructive means indiscriminately and 1.65 lakh ha of forest in cleaned and felled each year.

With the increase in population, rapid expansion of area under food and commercial crops, deforestation, extension of urban area, establishment of industries in rural areas etc., there is considerable depletion of plant Genetic Resources wealth, many of them being in the process of extinction day by day (Vijayalatha, 2004 and Singh, 2005).

In the present context of 'back to nature' in health care, it is very relevant that the valuable plant species are not only preserved but also their cultivation developed in order to meet the entire demand of the industries and export.

Unless steps are being taken to conserve and increase the cultivation of important plants many of our native plant species will become extinct and endangered.

Conclusion

According to the world Health organization (WHO) estimates, about 80% of the population of developing countries relies on traditional medicines, mostly plant drugs, for their primary health care needs. Thus, the picture of raw drug trade that unfold is quite complex. In order to meet the demand, about 86% of plant collection involves destructive harvesting. Due to this, many plants becomes endangered. Government regulation on wild collections of endangered species is necessary and inevitable to reduce the loss and degradation of natural habitats and over harvesting of some of these species. A reasonable degree of scientific vigour is needed to assess the threat status of species to be banned and evaluation must be done on several parameters.

Trade in natural products harvested from the wild, is a serious business. Government needs to take immediate steps to collect trade reliable information on current and projected consumption of medicinal plants. The conservation status of all species in trade and the conservation biology of threatened species should also be studied.

Banning trade needs transparent guidelines and scientific inputs in order to take balanced administrative decisions. Where species are not on the verge of extinction and consumption level is high and plant parts used do not involve destruction, i.e. leaf, flower, fruit, etc., a reasonable time can be given to industry to develop cultivation strategies. It is important in near future to take a shift from the current scenario of 86% wild harvest to a more sustainable regime, wherein perhaps 20 – 30% of the requirement may still be sourced from the wild while 70-80% should be from cultivated source.

This clearly opens up a huge challenge for conservationist, policy makers, researchers, industry and farmers to manage and use our natural resources wisely.

TECHNICAL SESSION - IV

BIOPROSPECTING, IPR AND BIODIVERSITY REGISTER

TIV–01 BIODIVERSITY RESOURCES: PRESENT STATUS AND FUTURE PROSPECTS

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Biodiversity is usually defined in terms of genes, species and ecosystems corresponding to three fundamental and hierarchically related levels of biological organization, called the genetic diversity, species diversity and the ecosystem diversity. Survey, exploration and documentation of biodiversity is being carried out mostly on trees and big game and often they are discussed and policies made, but very little work is going on, in microbial, marine, fresh water, desert, mountainous, polar and atmospheric life forms. Cataloguing of earth's biodiversity has been a continuous process and about 1.6 million species have been recorded so far and unexplored areas of high diversity are expected to reveal 5 – 30 million new species.

India is one of the 16 mega diversity countries located at the confluence of three biogeographic realms and has 10 biogeographical regions. It is considered as one of the 'Vavilov Centres' of agro-biodiversity. About 47,000 plant species have been recorded in India and it is estimated that a single crop plant- Paddy has about 16,000 land races in this country alone. The fauna of the country has about 86,000 described species, which represents about 6.4 per cent of the world's fauna. The ethnic diversity of the country includes over 550 tribal communities of 227 ethnic groups, spread over 5,000 forested villages.

It is the sum total of all such remarkable diversity, which has made the country a 'gene bank' for a number of food crops, forest trees, medicinal and aromatic plants and domesticated animals. Though the European explorers had carried out initial surveys, lot needs to be done now. Efforts are now made to find out what we possess in India, in different ecosystems. Since resources available for this kind of biosystematics work are limited, we have to judiciously use them to first study the species diversity instead of gene diversity. Specialised research institutions, however, need to study the variations at molecular level to produce new cultivars for meeting the demands of the increased population and industry.

Production of 'super plants' have the potential to threaten the existence of native varieties by occupying major parts of the landscape, when they are globally or regionally found acceptable because of their desirable traits, whereas production of 'super trees' may not pose serious threats to native varieties in any geographical area, as about 4 per cent of the land area of the country is notified as either National Parks, Wildlife Sanctuaries or Biosphere Reserves, where there is not going to be any kind of intervention by the forest department in the name of improving the yields.

With so many gadgets and so much of literature available in the 21st century, we can explore our treasure by adopting innovative methods. The ancient Indian sages could do it about 4000 years ago and had documented about 7000 plant species in great detail including mode and season of collection, how to obtain by-products, how to administer the 'medicine' and the dietary prescriptions. They had studied, validated, documented and codified the plants and their products for their medicinal uses and therapeutic properties,

which was then called as 'Ayurveda', an Upaveda of 'Atharvaveda', the most ancient literature on earth. Similar kinds documentation is available in the case of *Siddha* and *Unani* systems of medicine in India. What kind of D base management they had and how did they manage data warehouses? When the ancient people could be so innovative in their times, why can't we?

The 'Convention of Biodiversity' signed by more than 150 countries during the Earth Summit in Rio de Janeiro, in June 1992 was a milestone in the history of conservation of biological resources and their sustainable management. The Biodiversity Act, 2002 enacted by the Government of India was a major step towards conservation of biodiversity, its sustainable utilization and equitable sharing of benefits derived out of biodiversity resources among all the stakeholders.

Modern biology and biotechnology have unfolded unlimited potential for the use of microbes in areas such as enzyme technology, genetic engineering, immunology and environmental technology and lot more needs to be worked out in this regard. Taxonomists, who carry out research on the biosystematics, are not given due recognition, as industry and research institutions mandated to carry out applied research do not accord top priority to such basic research. We need to support the schools who pursue classical biosystematics and they should be encouraged and facilitated to network with specialists from biological sciences, agricultural sciences, microbiology, biotechnology, genetics, medicine, industry, banking, law and administration to explore and use the biodiversity for the benefit of mankind. Recently, an herbaceous plant *Trichopus zeylanicus* having rejuvenating, anti-fatigue and immuno-modulating properties, used by the 'Kani' tribe in Agasthyamalai area of Kerala was unearthed by the TBGRI, Tiruvananthapuram who characterized and patented the product and the benefits are shared with the community. There are many such plants, fungi, micro-organisms and animal products which need characterization, evaluation and patenting. Till such time they are surveyed, mechanisms completely understood and economic values are realized, we need to protect our biodiversity not only against destruction, but also from smuggling. India being a mega diversity country, it is the duty of everyone to guard the invaluable biodiversity resources and tap it sustainably, to bring prosperity to the nation.

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TIV–02 DOCUMENTATION OF TRADITIONAL KNOWLEDGE: PEOPLE'S BIODIVERSITY REGISTERS (PBRS)

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Documenting traditional knowledge in a participatory fashion can lead to protection of (Intellectual property Rights) IPRs of knowledge contributors and benefits sharing thereof can promote sustainable utilization of biodiversity. This is demonstrated by People's Biodiversity Registers (PBRs) in India, which are documents of people's knowledge of biodiversity and their perceptions about its usage, trade, besides efforts for its

conservation and sustainable utilization. The PBRs are developed by the local school/ college teachers and students and/or NGO researchers along with the villagers, at the level of villages. Biodiversity registers from villages can be compiled at the level oftalukas, districts, states and nation, in the form of computerized databases, to provide the relevant information to the people, government and industry. PBRs have been recognized by the Indian Biological Diversity Bill so as to ensure equitable access and benefit sharing, by recognizing such registration as prior art to scrutinize related IPR applications as well as the basis for sharing resultant benefits equitably. Similar provisions for recognizing these registers through their consolidated Indian digital database at the global level would help in reconciling the equity and conservation concerns with globalization. These global processes include Clearing House Mechanism of the international Convention on Biological Diversity (CBD), screening by the World Intellectual Property Rights (WIPO) and also the Trade Related intellectual property Rights (TRIPS). The important lessons learnt during the registration process include that its sustenance requires quick social recognition to local knowledge and practices of innovative and/ or sustainable use and conservation using local human resources. For, value addition to this knowledge and/or its IPR protection requires more time and resources at higher spatial scales, than grassroots stakeholders can imagine. The registers can be protected not by keeping in local custody but by publicizing their claims. Unique knowledge may be best used for rewarding innovative traditions and practices of sustainable use and conservation, beginning with local social functions, besides incorporating in the national innovations register. The royalty earned from commercialization of biodiversity and related public knowledge may be best distributed across villages in relation to their conservation efforts as promotional incentives.

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TIV–03 BIOPROSPECTING AND BENEFIT SHARING

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Bioprospecting is a process through which value addition can be made to the biodiversity of the earth. In the past Bioprospecting focuses on useful organic chemicals and now turning to nucleotide sequence information relevant to agricultural biotechnology and medical applications. Cyclosporine A production is the first example of Bioprospecting. Diversity Bioprospecting is high in western countries and transnational corporate biotechnology. In Convention of Biological Diversity (CBD), there are agreements with respect to the transfer of genetic resources from owner countries to countries or companies or individuals wants to use the resources. Bioprospecting companies often promise payments to benefit source countries. According to International Cooperate Biodiversity Group (ICBG), Intellectual Property Rights (IPR), the discoveries are shared and accrue to local communities and indigenous people in discovery of natural products. Although benefit-sharing agreements are frequently mentioned, the terms and conditions under which indigenous people will get the financial benefits is controlled by the industries.

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TIV–04 BIOLOGICAL RESOURCES AND BIOTECHNOLOGY: SOCIO-LEGAL IMPLICATIONS OF INTELLECTUAL PROPERTY RIGHTS

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Biotechnology, in recent years, has created unprecedented opportunities for the utilization of biological resources for the benefit of mankind but also for undertaking studies to understand the fundamental life processes. This technological advancement mainly benefited the developed countries and gave opportunity to exploit developing countries who lack expertise in bio-technology field. In the light of TRIP's agreement, the developed countries which are rich in technology but poor in biodiversity try to grab the biodiversity resources of developing countries.

It created an urgent need to protect the developing countries biological resources, a rich asset from the exploitation of developed countries. In this context 160 member countries of United Nations Organization entered into a social agreement i.e., United Nations Convention on Biological Diversity signed at Rio de Janeiro, *vide* NA.92-7807, came into force on 29th December, 1993. This Convention is aimed at the conservation of biological diversity, the sustainable use of its components and the fair and equitable sharing of the appropriate access to genetic resources and by appropriate transfer of relevant technologies taking into account all rights over those resources and to technologies, and by appropriate funding. This convention recognized the sovereignty of nations over their bio-assets and nations should utilize these resources in a sustainable manner. At the same time benefits arising out of bio-resources should be shared equitably between those who use the resources and those who own the resources, whether they are individuals, communities or the country at large.

The other related international social conventions related to biodiversity are Johannesburg Declaration on Sustainable Development, 2002, United Nations Conference on Environment and Development, 1992 held in Rio de Janeiro etc.,

India is a biodiversity rich country both in flora and fauna. It was recognized as one of the 25 hotspots in the world. Indian Constitution is the first to provide protection to environment. Art.48-A of Directive Principles of State Policy and Art.51-A of Fundamental Duty particularly deals with environmental protection includes protection of biodiversity.

In Indian Patent Act, 1970 measures were made to protect biodiversity and traditional knowledge have been provided and the provisions for compulsory licensing have been restructured to guard against abuses that may result from exclusive rights conferred by a patent.

As India is also one of the signatory of Convention on Biological Diversity, Indian government enacted Biological Diversity Act, 2002. Its main aim is to protect nation's bio-resources from foreigners, NRIs and a foreign corporate who exploit the resources without taking approval of the government and without sharing benefit. National Biodiversity Authority has been established under Sec.8 of the Act, which gives approval all

biodiversity related activities. Any person applying for Intellectual Property Rights in or outside India for any invention based on any research or information on a biological resource obtained from India should obtain previous approval of the National Biodiversity Authority.

National Biodiversity Authority contains an ex-officio member representing the bio-technology field. The another important duty of this legislation is safeguarding Indian biological wealth against bio-piracy and multiplication and restoration of endangered, rare and endemic species by using bio-technology and providing benefit sharing in intellectual property rights acquired by using Indian biological resources. The proceedings before this authority shall be deemed to be a judicial proceeding within the meaning of sections 193 and 228 and for the purpose of section 196 of Indian Penal Code and also be deemed to be a civil court for all purposes of section 195 and Chapter XXVI of the Code of Criminal Procedure, 1973. Offences under this Act shall be cognizable and non-bailable.

The other legislations related to biodiversity are Geographical Indications of Goods (Registration and Prohibition) Act, 1999, Protection of New Plant Varieties and Farmer's Rights Act, 2000 and Environmental Protection Act, 1984 etc., In a recent case, ***Research Foundation for Science and Technology and Ecology and others vs. Ministry of Agriculture and other,*** 2000(3) RAJ 129 SC. W.P. (Civil) No.212/ 1998, the Supreme Court in answer to a public interest litigation application, on the question of protecting India's Biodiversity particularly in relation to Basmati Patent dispute pending in USA, directed the Government to take appropriate action for protecting Basmati rice against piracy, keeping in view that the Government is proceeding with the legislations on biodiversity, Geographical Indications and Plant Varieties and Farmers Rights Protection.

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TIV–05 BIOCHEMICAL CHARACTERIZATION OF ENDOGLUCANASES FROM CELLULOSE UTILIZING *THERMOMONOSPORA* SP. AND THEIR APPLICATION

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It has been estimated that the annual production of ligno-cellulose, through photosynthesis, is 40 billion tons. Due to the large amounts of plant biomass in the biosphere, a wide range of plant-degrading organisms have evolved that use cellulose and hemicellulose as carbon and energy source, thereby recycling the carbon to the atmosphere and maintaining the carbon cycle on earth. The plant biomass degradation requires the concerted action of a multitude of enzymes, mainly carbohydrases, the majority of which are cellulases. There is a wide spectrum of biomass degraders, often referred to as cellulolytic organisms, from highly specialized species to opportunistic organisms. Different habitats in which cellulose is widely available have fostered interactions among cellulolytic and noncellulolytic microbes. The ease with which cellulolytic microbes establish mutualistic interactions with noncellulolytic microbes has important implications in natural environments Most microbes thought to play a prominent role in cellulose hydrolysis in nature, have evolved strategies that bring the cell close to the cellulose surface and give the cellulolytic organism "first access" to hydrolysis products. The

removal of certain polysaccharides by one species or group of microbes may improve the accessibility of a second group to cellulose.

Cellulases play a crucial role in developing eco-friendly technologies due to the environmental pressures imposed on the textile industry and the need to minimize water contamination. A novel alkalothermophilic actinomycete having optimum growth at pH 9 and 50°C was identified to be a new species of *Thermomonospora* based on the 16S rDNA sequence. The organism secreted maximally cellulase (endoglucanase) and endoxylanase 12 IU/ml and 200 IU/ml respectively in the extracellular culture filtrate. The cellulase was active and stable in an expansive pH range of 5 to 8. The enzyme was highly thermostable retaining complete activity at 50°C for more than 15 hours with a half life of 180 and 20 min. at 70 and 80°C respectively. It showed no activity towards crystalline cellulose. The culture filtrate of *Thermomonospora* sp. showed the presence of four different cellulases with Mr of 14.2, 38, 47 and 65 kDa (determined by SDS PAGE). The low molecular weight cellulase was purified to homogeneity and Mr was 14.2 kDa by MALDI - TOF analysis which is in agreement with gel filtration. The purified enzyme exhibited activity towards carboxymethyl cellulose (CMC) and xylan. The analysis of end products from the hydrolysis of CMC and xylan suggested an endo mode of action. Conformation and microenvironment at the active site of the enzyme was probed with fluorescent chemo-affinity labeling using o-phthalaldehyde (OPTA) as a chemical initiator to yield a stable fluorescent derivative with complete loss of activity of the enzyme to hydrolyze both CMC and xylan. Kinetic analysis and inhibition by OPTA are consistent with assumption of a single active site for the hydrolysis of CMC and xylan. The results of the present study suggest that an interrelationship exists between the xylanases and cellulase activities with probable ecological significance. The tryptic digestion of the endoglucanase yielded six major peptides. The sequence analysis of these peptides exhibited homology towards cellulose binding domain from *Thermobifida fusca* and *Streptomyces coelicolor***.** The peptide sequences were used for constructing the forward and reverse primers for amplification of the gene by PCR. A partial gene (400bp) was amplified, sequenced, cloned in PGEMT vector and transformed in *E.coli* JM 109. This gene fragment will further be used to probe the genomic DNA for obtaining the complete gene of the enzyme.

Evaluation of *Thermomonospora* cellulase for biofinishing of denim was carried out in collaboration with Ahmedabad Textile Industry's Research Association (ATIRA), India. *Thermomonospora* cellulase is efficient in removing hairiness causing the fuzz with negligible loss in total weight of the fabric preferred for biofinishing. Subjective evaluations of the performance of the enzyme corroborate its potential for biofinishing in textile industry. The cellulases from *Thermomonospora* sp. were effective under non-buffering - neutral to alkaline (pH 7-9) conditions, which is an added advantage for applications in textile industry. Since cellulose is made up of highly ordered crystalline region and less structured amorphous region, a single type of cellulase preferentially endoglucanase will be sufficient for degradation of amorphous cellulose causing fuzz and piling of the fabric. Hence *Thermomonospora* sp cellulase rich in endoglucanase with negligible activity towards crystalline cellulose appears to be a suitable candidate for biofinishing of denim.

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TIV–06 MICROBIAL BIODIVERSITY AND ITS APPLICATION TO PRODUCE INDUSTRIALLY IMPORTANT ENZYMES AND BIOACTIVE MOLECULES

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Biodiversity is recognized as a major factor in identification of novel gene pools. There are more than 10^{16} prokaryotes in one tonne of soil compared to a mere 10^{11} stars in our galaxy. Exploring microbial diversity is becoming more like exploring outer space with soil representing a "final frontier". In short, microbial diversity is beyond practical calculation. Our knowledge of microbes with reference to the extent of their diversity and role in sustaining global life-support system is rather meager. Variations in form and function among the various components of the living system essentially constitute biodiversity. The traditional methods of calculating diversity by identifying and counting organisms fail for microbes. The extremophiles are just representative examples of microbes recoverable to a small extent from natural hostile environments.

Enrichment cultures and use of selective isolation media formulation is widely used technique for isolating various novel microorganisms. This involves judicious use of antibiotics and selected chemicals to suppress the more abundant forms. This technique facilitates the growth of lesser abundant and slow growing species. Despite the well-known biodiversity 'hot-spots' of India, we find here many regions with high humidity, extreme temperatures, dense forests, deserts, mountains, sea-shores with high salinity and so on. Obviously, the microbial diversity in these areas could be unique. It is necessary to evaluate the extent of occurrence and distribution of the variety of microorganisms existing in a particular natural environment. The knowledge of microbial taxonomy and physiology is helpful in getting a better insight into the complexities of microbial biodiversity. It is also useful for identifying potentially endangered species. Pure culture isolation of microbes and their *in vitro* studies for determining the parameters for optimal growth ensure their conservation against extinction. In turn this would provide novel gene pools for biotechnological exploitation. There is an urgent need to explore the indigenous microflora of developing countries and organize germ plasm banks conforming to international standards. This will help National and International Organizations to build up resource pools of microorganisms from the native environment for microbiological and biotechnological research and development. National Collection of Industrial Microorganisms (NCIM), at NCL, Pune is a national facility dedicated to isolation, preservation and distribution of authentic cultures. NCIM consists of around 3700 strains of algae, bacteria, filamentous fungi and yeasts. Only non-pathogenic cultures are maintained at NCIM. It is one of the largest culture collections in India and South East Asia. It is a member of World Federation for Culture Collection. Culture collections play a pivotal role in the area of biotechnology. However, their meaningful exploitation is possible only if the properties of cultures are documented and their information is easily accessible. It would be profitable to identify the microbial strains that produce high value enzymes and unique bioactive molecules.

The microbes have remarkable ability to produce wide range of secondary metabolites such as proteinase inhibitors and drugs. At NCL, we have isolated and studied several microorganisms that produce industrially important products such as (alkali-stable/active) cellulases, xylanases, pectinases and glucosidases. Using

promising strains it is possible to convert forest waste residues into liquid biofuels. There are selected cultures that produce high activities of pullulanase, proteases, glucose isomerase, chitinase, phytase, proteinase inhibitors, drugs, and exopolysaccharides. The market for technical enzymes accounted for 63% in 2005. The world market for industrial enzymes is about $ 1000 million with an average growth rate of 10% per annum. We have isolates that produce novel lectins as well as yeasts that convert pentose into ethanol/xylitol. Some isolates are found to be useful for the complicated biotransformations that are becoming essential to the fine chemical industry. Here we would like to highlight some of the microorganisms isolated in NCL that produce commercially significant products.

Penicillium funiculosum: Produces stable and efficient cellulase complex (50-60 IU/ml) with significant β-glucosidase (15-25 IU/ml). It also produces extracellular dextranases that has role to play in sugar industry.

Sclerotium rolfsii: Besides high activities of cellulases (100 IU/ml) and xylanases (220 IU/ml), it produces significant activities of β-xylosidase and α-L-arabinofuranosidase (1.5-2.5 IU/ml). *S. rolfsii* also produces extracellular pullulanase (2 IU/ml), a debranching enzyme that produces high glucose syrup from starch.

***Fusarium* Sp.**: Produces alkali active/stable cellulase that is useful for removing Xerox toner from the waste paper for recycling (Biodeinking). Also produces a unique lectin.

Neurospora crassa: Useful for bioconversion of pentoses into biofuels.

***Thermomonospora* Sp**: Produces alkali-stable cellulases suitable for ecofriendly treatment to natural fibres (Biopolishing). These enzymes are in demand for giving "fading" effect to the denim cloth for quality jeans.

Candida bombicola: This immobilized yeast is involved in biotransformation of pharmaceutically important costly drugs like 19 HETE and 20 HETE.

Chainia Sp: Produces extracellular free cellulase stable xylanase useful in paper/ pulp industry. The culture was isolated in the hot region of Haldi-Ghat (India).

Yarrowia lipolytica: NCIM 3589: Produces a useful emulsifier for oil recovery.

Xanthomonas Sp: Many strains are isolated that produce unique gum like xanthan.

Conidiobolus Sp: Produces alkaline proteinase inhibitor that we can substitute in place of hazardous chemicals for developing ecofriendly leather related cottage industries.

Bacillus Sp: Produces an aspartic protease inhibitor has been shown to inhibit recombinant HIV-1 protease, pepsin, and the protease from the *Aspergillus saitol.*

Metarhizium anisopliae: Produces chitin deacetylase that converts chitin polymer into its deacetylated form chitosan.

Rhodococcus Sp: Nanobiotechnology is an upcoming area of research. Using promising microbes NCL has synthesized nanoparticles of NiS, ZnS and MnS.

Health, agriculture and environment have a high profile in India. In each of these areas, the microbial biodiversity of India has much to offer to exploit potential resources of our dense forests for the benefit of our people in the years to come.

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TIV–07 OPTIMIZATION OF COLOR PIGMENT PRODUCTION FROM FILAMENTOUS FUNGI ISOLATED FROM WESTERN GHATS (NILGIRIS) BIODIVERSITY

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Western Ghats is regarded as one of the mega biodiversity hotspot in the world endowered with very rare species of flora and fauna. The Western Ghats are the range of mountains along the west coast about 1600 km long, 80 – 100 km wide, running continuesly from the mouth of the river tapti in Dhule district of maharastra to kanyakumari in Tamilnadu. They are a steep and rugged mass of hills, with elevation varying from 100 to 2700 M towards the south and culminating in the Nilgiris with Dodabetta at a height of 2636 M. Immediately south of the Nilgiris plateau lies the only break in the continuity of the Western Ghats, the Palagat or Coimbatore gap. These Western Ghats are spread over the states of Maharastra, Karnataka, Tamilnadu, Kerala and Goa. This region is largely covered under agro – ecological region.

These Nilgiris biosphere reserves one of the 13 biosphere reserves of the country, is located in the Western Ghats speeded over an area of 5520 sq km covering the southern state of Tamilnadu, Kerala, Karnataka. Wide varity of soil types (12 types) are found in the Western Ghats region. These consist predominantly of laterite and laterutic soil, black, red sandy, red loam and forest soil. Mixed red and black, costal alluvium, riveine alluvium, dark brown and deep black soils are found in this region.

The wide varity of life forms participate in the below ground activities. The forest communities include viruses, bacteria, actinomycetes, fungi, algae, protozoa, arthropods, earthworms, amphibians, reptiles and mammals. Among them microorganisms are present in large numbers and participates in numerous physiological processes The se dynamic process involve saprophytism, pathogenicity and symbiosis. The most wide spread of the symbiosis among plants is the fungal association. Some of the fungi found to be economically important .So for 15,00,000 species were estimated and 70,000 were described. About 27,500 taxa are presently known from Indian subcontinent and very small portions of these are available in culture repositories

Sixty soil samples were collected from different locations of the Western Ghats (Nilgiris) and pigment producing fungi were isolated. More than 45 isolates were producing color pigments, some are intracellular and some are extracellular. Industrial utilization the natural pigments are used in food, cloth, pharmacy and beverage for imparting pleasing attractive color. Apart from many microorganisms fungi are found to be the potential source of pigment producers. Hence the study has been carried out to isolate economically important pigment producing fungi from the Western Ghats soil samples. More then 16 isolates were producing red pigment, 8 isolates were producing brown pigment, 6 isolates were producing yellow pigment, 4 isolates were producing orange pigment and one isolate produced blue color pigment which was intracellular. This rhizosphere soil samples showed the high potentiality in harboring pigment producing fungi.

Effect of different media, carbon, nitrogen, pH, temperature, agitation and light on the optimum production of selected pigment producer of selected (TH4) further was studying, Biomass, crude Protein, pigment concentration.

TECHNICAL SESSION - V

MICROBIAL BIODIVERSITY AND ITS ROLE IN SOIL PROCESSES

TV–01 ROLE OF MICROBIAL DIVERSITY IN FOREST ECOSYSTEM FUNCTIONING

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Fungi are eukaryotes having well-defined membrane-bond nuclei with a number of definite chromosomes and, as such, clearly distinguishable from bacteria. They are heterotrophic, requiring organic carbon compounds of varying degrees of complexity which distinguishes them from plants and manufacture their own organic food. In older classification systems, fungi were included within the plant kingdom and were separated from other plant groups by the lack of photosynthesis and the production of spores. The number of fungi recorded in India exceeds 27,000 species, the largest biotic community recorded after insects (Sarbhoy *et al*., 1996). Wherever forests flourish, fungi establish themselves as saprophytes that decompose wood, as mycorrhizal mutualists on roots, internal endophytes, epiphytic lichens, and parasites that attack living trees. In addition, one of the least studied, yet imaginable, roles of endophytic fungi is to initiate the biological degradation of the dead or dying host plant, which begins the critical processes of nutrient cycling.

Ecological studies have found that, in forest soils, the biomass of fungi is 90% of the total and outweighs the biomass (= living stuff) of all other microorganisms and mesoorganisms. The roles of massive fungal component in major biological systems are 1. decay organisms of plant debris. 2.mycorrhizal partners with trees and other plants. Fungi are an important part of the biota of the soil, and in addition to functions based on their mode of nutrition affect physical characteristics of the soil such as wettability and integrity of the soil crust. The metabolism of saprophytic fungi and bacteria decomposes complex organic molecules such as polysaccharides and proteins into simple inorganic compounds such as carbon dioxide, nitrate, and other materials that plants can assimilate as raw materials for photosynthesis. Fungi are known to play vital roles as decomposers, symbionts of plants and animals and are also parasites on plants in different ecosystems. The biodegradation of cellulose and lignified cellulose reaches staggering levels and is responsible for the return of hundreds of billions of tons of C02 annually to the atmosphere and is a major biological component of the terrestrial carbon cycle (Hudson 1962).Fungi are the major players in this process through biodegradation of cellulose by decay fungi and synthesis of cellulose by virtue of their role in mycorrhizal associations. When we consider the amount of active fungal hyphae utilized in the biodegradation of all the woody debris and add the enormous amount of mycorrhizal hyphae associated with each tree, it is no longer surprising that the biomass of fungi is 90% of the total living organic material in forest soils.

The forest tree obtains almost all the water and minerals required through extensive networks of hyphae of mycorrhizal fungi. If 90% of the living organic material (=biomass) in forest soils were fungus, this would surely be the largest pool of nitrogen and phosphorus available and afford the best solution to any nutritional limitation. The health of most forests is directly related to the presence, abundance and variety of mycorrhizal associations. These are fungi which exhibit mutualistic relationships with plant roots; 90% of trees probably have them. Their presences significantly increase the roots' effective absorptive surface area and provide for a direct link between the processes of decomposition (which yields raw materials) and the absorption of these materials by plants. Mycorrhizae are beneficial both in nature and agriculture. Plants with them tend to

grow better than those without them. It has been demonstrated that many mycorrhizal fungi secrete external proteases. This recalls the unexpected production of cellulases by nematophagous fungi. Ectomycorrhizae absorb moisture and essential elements, and translocate them to their host plants, making ectomycorrhizae essential for the development of such ecosystems (Marks and Kozlowski, 1973; Harvey *et al* 1979; Harley and Smith, 1983; Maser, 1990). Therefore, we assume their presence and abundance to be a good indicator of healthy, functioning forest soil. Wood decomposition is a profoundly important process in forest ecology.

Fungi are responsible for weakening trees, they are key determinants of gap dynamics in forests. This small-scale process is one of the most important elements of chaos and helps to maintain forest heterogeneity and counterbalances vegetative succession. Especially in forests, a large part of the nutrient flux is mediated by fungi. The healthy functioning of forest fungi is of paramount importance to all the forests of the world. The study on fungal ecology is at an early stage of development. There fore there is a more research to obtain valuable information. Whole ecosystems, such as riverine estuaries, coral reefs, mundane forests, and the creatures that live in them, are under stress due to human difference. They clean the environment and making human existence possible.

Approximately 27,500 taxa are presently known from Indian subcontinent and very small portions of these are available in culture repositories. We has been working on the biodiversity of actinomycetes bacteria and fungi in Western Ghats (Nilgiris) from different source. **The fungal population varies between 26 x 10^3 to 14 x 10^4cfu/g and bacterial population varies between 160 x 10^6 to 80 x $10^7$of soils.** The fungal and bacterial isolates were found to elaborate brown, purple, yellow, orange and blue colored pigments. These metabolites are extensively useful in human welfare. The industrially important microorganisms are scarcely tapped. The specialists have to look for newer tools, novel media, and newer isolation techniques for screening economically and industrially important microorganisms.

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TV–02 VAM FUNGAL DIVERSITY OF FOREST TREE SPECIES IN DRY DECIDUOUS FORESTS

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In nature tree crop establishment none of the inoculants were given and hence the tree crop grown in virgin soil. There are very much affected by certain biotic factors. VAM fungi have amply demonstrated their influence on physiological benefits conformed buy them on potential host plants. In Dharwad district of Karanataka dry deciduous forest have been selected for the present work. Fourty five forest tree species have been screened for their VA mycorrhizal association. Per cent of root colonization does not collected with spore number nor VAM spore species with site. Diversity of VAM species were arranged descending order for each tree species 34 VAM species were recorded the *Glomus* species were most predominated over *Scutellospora*

and *Gigaspora*. Again seasonal fluctuation VAM spore dynamics varied. Monsoon and summer season significantly increased spore population than winter season.

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TV–03 AGARIC DIVERSITY IN PONDICHERRY – A PRELIMINARY STUDY

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Agarics, the gilled-mushrooms, belonging to the order Agaricales in Kingdom Mycota are the group of organisms that produce ephemeral fruit-bodies during rainy season. A preliminary study was undertaken to know the agaric diversity in Tagore Arts College Campus, Pondicherry, which is dominated by plant species including *Azadirachta indica*, *Casuarina* sp. and *Ficus benghalensis*. Mushroom fruit bodies were sampled during June to October 2005. A total of 27 species were recorded that belonged to 13 genera. White-spored species dominated over dark-spored species. Members of Agaricaceae and Tricholomataceae were dominant. The species recorded belonged to *Agaricus, Calocybe, Chlorophyllum, Conocybe, Gerronema, Lepiota, Leucoagaricus, Marasmius, Pleurotus, Psathyrella, Schizophyllum, Termitomyces* and *Volvariella,* The dominant genera were *Agaricus*, and *Lepiota.*

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TV–04 STUDIES ON FEW NATURAL WATER BODIES OF COORG: A TINY DISTRICT OF KARNATAKA

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Coorg or Kodagu is a little hilly district in the South Western part of Karnataka. It was incorporated with the Madras presidency. Different rulers of the region made the exploration of the geography, fauna, flora, ethnic variety, customs and manners. The journey over the district experienced beautiful hills and valleys. The geography is fascinating with suductive charm peaks and valleys with a gurgling streams, rivers and terrain, the only series of hills vary in the point of elevation ranging from Subramuhain on the north to Brumagiri hill on the south. The Todiandamol hill is one the beautiful hill about 5682 feet from the sea level.Kodagu is partly separating from Mysore and from Kerala. Coorg is covered by forest with the coffee plantation. Here and there number of the permanent water streams, rivers and tanks are found .One of the most important river is the Cauvery river originated at Talacauveri, runs via Mysore, Chamarajanagar District and reach Mettur dam in Tamilunadu. The river Kaveri attracts lakhs of devotees for its divinity and Nymph of exquisite beauty of its rise. Most of people

of Kodagu are dependent on the natural streams, rivers and ponds for their drinking, domestic and irrigation purposes. Hence, physico-chemical and microbiological studies of few such water bodies of this forest district are studied. The maintenance and conservation of such water bodies is the need of the present day.

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TV–05 STUDIES ON MACRO FUNGAL DIVERSITY IN MOIST DECIDUOUS FOREST

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The present study is concentrated in the Moist Deciduous forest of Malnad region. Kuvempu University is located in the foothills of Western Ghats. The average rainfall is about 840.2 mm, temperature is avg. of 25ºc & relative humidity is 45-85%. Due to high humidity and humus accumulation, provides the luxuriant growth of Micro and Macro fungal diversity. Our previous study evidenced the information on Macro fungi in the Malnad region of Western Ghats. The major floral diversity are of species *Terminalia paniculata, T. tomentosa, T. bellarica, Lagertroemea lanceolata, Anogeissus latifolia, Tectona grandis, Xylia xylocarpa, Bombusa arundinacea, Dendrocalamus strictus* and *Randia dumetorum*Macrofungi were collected from the 450 acres of Moist Deciduous forest in the Kuvempu University jurisdiction. Total of 280 Macro fungi from April 2005 to January 2006 were collected, characterized and preserved in Department collection. About 50 were identified to Genus level and 30 were identified to Species level. Among these different Macro fungi, the Genus Microporus is dominant then Tremella, Polyporus, Auricularia and Ganoderma. Many of them were Medicinally important, some species are edible fungi. The characterization of these Macro fungi was done based on their Morphological structure and the habitats, with the help of pictorial guides and with the assistance of Internet.

Currently identified Macro fungi in Genus level are Chanterella sp., Amanita sp., Hypholoma sp. , Ramaria sp. , Lactarius sp. , Leucocoprinus sp. , Lepista sp. , Tricholoma sp. , Clavaria sp. , Geastrum sp. , Geopyxis sp. , Albatrellus sp. Species level identified Macro fungi are Auricularia auricula, Cyathius striatus, Calocera viscosa, Stemonitis splendens, Sterum ostrea, Daldinia concentrica, Xylaria polymorpha Hygorcybe singeri, Coprinus plicatilis and Geoglassum fallax. Some of Macro fungi, very common in the Kuvempu University jurisdiction are Dictyophora cinnabarina and also rare species of Boletus, Cordyceps and Aleuria. As per the literature revealed most of the Ganoderma and other species are medicinal and pharmaceutically important.

An attempt is also made to study the Biology of Dictyophora cinnabarina . The detailed aspects are discussed in the main paper.

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TV–06 DIVERSITY AND DISTRIBUTION OF MACROLICHENS IN THE KERALA PART OF WESTERN GHATS, INDIA

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About 2450 species of lichens are known to occur in India. During intensive field explorations, 254 species of macrolichens under 43 genera belonging to 18 families were collected and enumerated. The occurrence of 254 species in an area of 38,863 km^2 exhibits the richness and diversity of the macrolichen flora in the Kerala part of the Western Ghats. The 254 species recorded from this study area form 36 per cent of the estimated macrolichens of India. Among the 18 various localities surveyed during the study, some of the areas like Silent Valley National Park, Palakkad District, holds highest number of species with 159 macrolichens under 28 genera belonging to 12 families. Mannavan shola of Idukki District, forms the second largest with 101 macrolichens followed by Siruvani-Muthikulam hills (60 species), Nelliampathy hills (47 species), Silent Valley Estate of Munnar (39 species), and Uppupara area of Periyar Tiger Reserve (39 species) possess large number of macrolichens.

Evergreen forests show maximum species diversity with 133 species under 32 genera, 62 species under 24 genera are found exclusive to this type of vegetation. Subtropical forests hold 46 species under 18 genera, six species under five genera are exclusive to this region. Grasslands hold 56 species under 25 genera, 17 species under 12 genera are exclusive to this region and shola forests have 99 species under 27 genera, 43 species under 21 genera are found exclusive to these vegetation. Ecotone regions in the evergreen - savannah margin and montane shola - montane grassland in higher altitudes constitute 65 species of macrolichens under 20 genera to their credit, 18 species under 10 genera are exclusive to this region. About 108 species of macrolichens are found overlapping among other vegetation types.

The family Parmeliaceae dominates with 80 species under 14 genera followed by Physciaceae (45 species under 6 genera), Usneaceae (40 species under 1 genus), Collemataceae (29 species under 2 genera), etc. The genus *Usnea* dominates with 40 species followed by *Parmotrema* (25 species), *Heterodermia* (24 species), *Leptogium* (23 species), etc. Fortythree genera are represented by a single species under each. Nine species viz. *Hypotrachyna* (1 species), *Parmelina* (2 species), *Parmotrem*a (2 species), *Ramalina* (1 species), *Stereocaulon* (1 species) and *Usnea* (2 species) are found to be new taxa. Species like *Cladonia carneola, C. foliacea, C. glauca, Parmelina phlynctina, Phaeophyscia nepalensis, Ramalina subampliata, R. usnea, Usnea albopunctata* and *U. vegae* are new records to India. *Parmeliella pannosa* so far known from Andaman Islands has been collected from the mainland. Sixty-five species were found to be new records to peninsular India and 109 species new records for Kerala.

Community studies showed that west coast tropical evergreen forests and subtropical broad-leaved hill forests favour mostly cyanolichens. Montane wet temperate forests supports all type of lichens and grasslands

inhabit lichens mostly with green algae as its photobionts. PCA and regression analysis showed that altitude, temperature and wind velocity are the prime factors responsible for the distribution of macrolichens. This is probably the first report of the detailed study of lichens and its environmental implications from the Western Ghats. The host species for lichens from different vegetation types are also recorded for the first time.

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TV–07 ECTOMYCORRHIZAL DIVERSITY IN TROPICAL FOREST ECOSYSTEM

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Ectomycorrhizal (EM) fungi can contribute up to 25% or more of root biomass of forests, thus contribute effectively as a major structural component of the forest ecosystem. But such fungal forms can help to develop management strategies of plants at community or local level, only if appropriate information with respect to species richness is known. Recently, the species diversity of epigenous EM fungi of Western Himalayas on oaks (*Quercus leucotrichophora* and *Q. floribunda*), pines (*Pinus roxburghii* and *P. wallichiana*) and deodar (*Cedrus deodara*). has been reported (Pande *et al*., 2004)Species richness values for EM in oak and conifer forests were 43 and 55 respectively, which were close to midpoint range for similar other forests studied globally. In terms of the relative number of species, EM genera declined in the order; *Amanita* > *Boletus* > *Lactarius* > *Hygrophorus* >*Cortinarius*. There was clear-cut host specificity as well, with *Amanita* primarily associated with conifers and *Boletus* and *Russula* with oaks; forests exhibiting dominance of EM hosts, however, had low tree diversity.

In the Western Himalayan region, forests occur from the foothills to about 3500 m altitude and all dominant tree species have ectomycorrhizal association. The dominanttree species are *Shorea robusta* (Sal) in the foothills, *Pinus roxburghii* (pine) from 1000 to 1800 m, *Quercus* sp. (oak) from 1000 to 3000 m, *Cedrus deodara* (deodar) from 1800 to 2200 m, *Abies pindrow* (silver fir) from 2400 to 3000 m, *Betula utilis* (birch) from 2800 to 3500 m altitude.

All the ectomycorrhizal fungal species were categorized into three groups depending upon their host range, viz. narrow, intermediate and broad (Molina et al., 1992). The narrow host range included fungi forming ectomycorrhizal association with only one genus of the host family. The fungi in the intermediate host range category were limited to a single family of host plants, while those belonging to the broad range formed mycorrhizal association with diverse host plants typically crossing between plant families, order and even classes.

Across the oak and conifer forests of the Western Himalaya, the total number of epigeous fruiting fungi recorded was 298. Among these, ectomycorrhizal and non-ectomycorrhizal, soil-inhabiting macrofungi were 101 and 197 respectively. The ratio between them was about 1: 2 (33.9% mycorrhizal and 66.1% non-mycorrhizal). The total number of ectomycorrhizal species was 43 in oak forest and 55 in conifer forest. The major ectomycorrhizal fungal genera in terms of species number were *Amanita*, *Russula, Boletus, Lactarius, Suillus, Hygrophorus, Cortinarius* and *Lecinum* (Table 1). *Amanita* was predominantly mycorrhizal with pines, and *Boletus* and *Russula* with oaks. *Sillus* showed extreme host specificity, as all seven species were associated with pine. *Lactarius* indicated a wider host range. Out of nine species of this genus, five were associated with oaks and four with conifers. *Cortinarius* and *Hygrophorus* were also found to be mainly associated with the roots of conifers. However, one species each was mycorrhizal with other trees, viz. *Betula* and *Rhododendron* respectively (Table 1). When both ectomycorrhizal and non-ectomycorrhizal fungi are considered, the following genera are most important in terms of species number: *Boletus* – 41 sp. (12 mycorrhizal, 29 non-mycorrhizal), *Russula* – 34 sp. (13 mycorrhizal, 21 non-mycorrhizal), *Lactarius* – 24 sp. (9 mycorrhizal, 15 non-mycorrhizal), *Amanita* – 23 sp. (15 mycorrhizal, 8 non-mycorrhizal), *Coprinus* – 13 sp. (all non-mycorrhizal), *Agaricus* – 12 sp. (2 mycorrhizal, 10 non-mycorrhizal), *Cortinarius* – 10 sp. (5 mycorrhizal, 5 non-mycorrhizal) and *Inocybe* – 9 sp. (2 mycorrhizal, 7 non-mycorrhizal).

Table 1. Important ectomycorrhizal fungi of Western Himalaya and their association with oaks and conifers

Genus	Total mycorrhizal species	Per cent association with	
		Oaks	Conifers
Amanita	15	20	80
Russula	13	80	20
Boletus	12	83.3	16.6
Lactarius	9	45.5	55.5
Suillus	7	–	100
Hygrophorus	4	25	75
*Cortinarius**	4	–	75

*Twenty-five per cent of the remaining species of *Cortinarius* are associated with *Betula*.

Understanding the factors that control diversity is high on the agenda for ecologists and conservationalists but the focus is generally on the above-ground processes. What is happening beneath the soil is ignored. Recently, it has been experimentally shown that the reduction in plant diversity in old

field grassland habitat largely occurred due to the effect of roots. They stressed that roots of some species were more effective in tapping soil nutrients than others, thus achieving dominance. The effect of below-ground processes on the above-ground species dominance or species diversity is likely to be modified by mycorrhizal activity and fungal symbionts.It seems that the ectomycorrhizae, by enabling the host to effectively tap resources through a prolific mycelial network, promote exclusion of other species having arbuscular or other forms of mycorrhizae. Formation of single species stands in the Western Himalayan region by ectomycorrhizal host encompasses widely different trees species

such as tropical sal (*S. robusta*), sub-tropical and temperate pines *(P. roxburghii* and *P. wallichiana*) and deodar (*C. deodara*), oaks of different climatic belts (*Quercus floribunda, Q. leucotrichophora* and *Q. semicarpifolia*) and birch (*B. utilis*).

This report on species diversity of ectomycorrhizal fungi mainly concerns oak and conifer forests of the Western Himalaya. These forest communities are part of a wide altitudinal transect largely dominated by trees having ectomycorrhizal fungi. This feature warrants attention because the transect includes a range of over 15 ºC mean annual temperature and widely different conditions of topography, soil and precipitation. The diversity values of ectomycorrhizal fungi may not represent the actual picture as not all studies are based on thorough sampling; nevertheless, they give an approximate estimate of ectomycorrhizal diversity which falls within the range described for similar forests elsewhere, thus lending support to certain generalizations relating to ectomycorrhizal diversity at the forest community level.

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TV–08 MUSHROOMS IN THE NORTH-EASTERN HILLS OF INDIA

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Various types of mushrooms occur in the hills of Arunachal Pradesh. Among them some are poisonous anther are edible. Mushrooms are an integral component of forest ecosystem. Their fruiting bodies occupy diverse ecological. They appear during the rainy season beginning ordinarily with mid-April till mid-September. Some of them are predominantly winter mushrooms. Some mushrooms have mycorrhizal association with roots of higher plants. About 25 species of mushrooms have been collected and identified as edible among the local people. These mushrooms belong to the genera of *Agaricus, Amanita, Pleurotus, Armillaria, Coprinus, Cortinarius, Crepidotus, Flammulina, Lentinus, Volvariella and Boletus.* Even among these species the preferences of the people have been observed to differ in different areas. Further some of these fungi are considered edible in one part and non-edible in other past. Probably owing to the lack in communication facilities because of different terrain in the past,

but all these are consumed regularly during seasons of their appearance in nature by the local inhabitants. These are not only consumed fresh but collected and dried for use during winter months. Button stages are preferable for consumption because they are without infestation.

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TV–09 A STUDY ON THE BIODIVERSITY OF PLANT COMMUNITY AND SOIL BACTERIA IN THE SEMI ARID PASTURE LANDS OF KOVILPATTI INFESTED WITH *PROSOPIS JULIFLORA*.

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Prosopis juliflora is an alien species, had been introduced into Tamilnadu for specific purpose like fire wood and hedge plantations. The *Prosopis juliflora* has become dominant vegetation in the waste lands and pasture lands. The *Prosopis juliflora* has transformed the landscape of many places.

The present study was carried out to assess the biodiversity of endemic native flora in the semi arid pasture lands of Kovilpatti (9° N 78°E), infested with *Prosopis juliflora*. The field studies were carried out between September and December 2005. Most of the annual herbaceous plants establish in this area during the rainy season and coming under this period. The Biodiversity assessment had been carried out using 4 X 50 meter rope quadrates with replicates in two selected sites (Site A and Site B) around Kovilpatti. Site A – Ayyappan nagar area is situated in the west of Kovilpatti, wherein the *Prosopis juliflora* is sparse in the field and the *Prosopis juliflora* plants are aged less than two years. The second study area Site B is Nally area situated in the north of Kovilpatti. In the site B the *Prosopis juliflora* is well established and formed impenetrable thickets. They were more than seven years old. The soils of both the study sites are black cotton clay soil and the pH of the soil is around 8-9.

The plant frequency, density and abundance of the plant populations of the study sites were analyzed. Soil samples were taken from the under storey of *Prosopis juliflora* vegetation in site A and Site B. The microbial populations of the soils were analyzed. By analyzing the density and abundance, it has been observed that the biodiversity of the flora were much affected in the site B. The ground cover vegetations were limited in the site B.

The microbial population of the soil from the under storey of *Prosopis juliflora* vegetation in the site B was analyzed. Only two morphological forms are noted, i.e. coccus and bacillus. The soil sample of site B showed more Colony Forming Units (CFU) in the 10^5 dilutions, than the soil in site A.

The microbial population of the soil from site A showed lesser CFU in the 10^5 dilutions. However many types of morphological forms were noted in thee soil with out *Prosopis juliflora* i.e. coccus, streptococcus,

spirillum and bacillus forms. Soil erosion is evident in the site B, due to lack of enough ground cover. The study had provided factual evidence to prove the detrimental effects of *Prosopis juliflora*. Controlling the invasion of *Prosopis juliflora* in the pasture lands is discussed.

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TV–10 BIO-MANURE FROM WASTES AND ITS APPLICATION TO CONTAIN DISEASES OF FOREST SEEDLINGS

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Forest seedlings to tune of 20 to 40 per cent are lost to soil borne pathogens and rarely control measures are adopted. Simple media mix, which could suppress the pathogens and also support good growth of the seedlings, would be a boon to foresters to raise quality disease free seedlings. *Pleurotus* spp are well known wood decaying fungi, which are cultivated world wide for its food value. More than dozen *Peurotus* spp are know to be edible and they have been exploited for their ability to degrade the lignocellulosic wastes and conversion to a valuable biomanure, which act as a good media mix for raising forest seedlings and also helps in containing soil borne diseases of forest seedlings, especially in Eucalyptus. This paper discusses the bio-potentials of the wood decaying edible fungi and their possible exploitation for management of soil borne pathogens. India is endowed with potential renewable organic wastes like crop residues, tree wastes and aquatic weeds etc., (Gaur, 1986). The organic waste available in India are estimated to supply around 7.1, 3.0, 7.6 million tones of N, P2O5 and K2O respectively (Marimuthu et al., 1997, 1999). Such organic wastes, especially coconut coir pith, was decomposed to narrow down its C:N and Lignin- Cellulose ratio so that it becomes a good organic manure suitable for vigorous growth of Eucalyptus seedling. By suitable combination with regular media mix it could serve as an excellent medium for raising forest seedlings and also serve as s source to suppress dreadful pathogens like *Pythium, Macrophomina* and other soil borne pathogens. This type of media mix developed from composting the coconut coir pith served as s source of good medium to produce vigorous forest seedlings and also helped to contain soil borne pathogens, which are commonly occurring in the forest nurseries. This kind of bio-manure could further be amended with bio-inoculants like *Trichoderma* to produce a valuable bio-manure. This technology could also be extended to other forest and crop diseases.

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TV–11 THE ROLE OF SOIL BIODIVERSITY IN BIOGEOCHEMICAL CYCLE WITH REFERENCE TO DECOMPOSITION PROCESS IN FOREST ECOSYSTEMS

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The significance of biodiversity to soil processes is viewed directly through their role in biogeochemical transformations including the detritus process of litter decomposition and nutrient cycling. Diversity of soil biota is very vast but many of these organisms in forests are unexplored. The functional diversity in soils is great and exceeds a high degree of the species richness. Besides, the identification of "keystone species' and their positive interaction in the soil systems is very important. However, these views provide little information on the significance of soil biodiversity towards their contribution to biogeochemical cycling. The present paper attempts to describe their importance in ecosystem function and ecosystem services, which has been largely overlooked.

Soil biodiversity through their role in various soil processes modify the physico-chemical and biological characteristics of soils in different ways and helps in the pedogenesis and soil formation, and soil productivity particularly in forests. The direct effects of diversity of soil microarthropod biota on biogeochemical cycling result from the enhanced mineralization of nutrients through feeding on the soil microflora and fauna, and comminution of plant detritus and fecal deposition, enhancing the surface area for microbial activity and leaching of water soluble chemical constituents. Similarly, the macrofaunal biodiversity of earthworms, the epigeic species facilitate the breakdown and mineralization of surface accumulating litter while anecic species incorporate organic matter in the deeper layers of the soil profile enhancing the percolation of water through their burrow.

The soil biota have various hierarchies in the structure of their communities, which influence the spatial heterogeneity of resources that are supported by different kinds of biologically relevant spheres which include detritusphere, the drilosphere, the porosphere, the aggregatusphere and the rhizosphere, which operate at different spatial scales, the former sphere being the zone of recognizable plant and animal detritus undergoing decomposition harboring a diverse soil biota, influence the structure of decomposer communities by the chemical composition of the detritus; the drilosphere being the zone inhabited mainly by earthworms where the leaf litter middens are seen around their burrow openings and the soil volume descending along the burrows; the porosphere being the zone influencing soil biota that affecting the pore size distribution through bio-pore development and the formation and disruption of soil aggregates, occupied by a wide variety of soil biodiversity ranging from bacteria, mycelial fungi, protozoa and nematodes to micro-arthropods; the aggregatusphere being the surface of aggregates and microhabitats of soil biodiversity containing all organic matter constituents, solutes and gases and the soil biota contributing to the aggregate formation while the rhizopshere, the zone of primary root influence and the products of rhizodeposition stimulating microbial activity, with biomass of soil micro-biota being usually greater than

the root-free soil, though the species diversity may not follow the same trend. The biodiversity of soils may contribute very significantly to various soil processes through the formation of a spatially and temporally heterogeneous structure.

A broader view of soil biodiversity can give a better understanding of the significance of biodiversity in biogeochemical cycling including litter decomposition and nutrient release and cycling in the forest ecosystems, which can provide different levels of resolution such as i) the significance of soil biodiversity to specific processes, for example, the detritus process of litter decomposition and nutrient cycling, ii) their complex and specific interactions in soil systems that regulate the biogeochemical cycling, and iii) the biodiversity in relation to different spatial and temporal scales that influence the functioning of soil systems and ecosystem services of forests.

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TV–12 ECOSYSTEM RESURGENCE IN RELATION TO SOILS DUE TO FIRE IN THE EVERGREEN AND DRY DECIDUOUS FORESTS IN KERALA, INDIA

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After the occurrence of fire 12 - 17 years back in the West Coast tropical evergreen and dry deciduous forests in Kerala, a study was carried out to assess ecosystem resurgence with special reference to soils. Particle-size separates, bulk density, particle density, maximum water holding capacity, soil pH, organic carbon, available N, P, K, Ca and Mg contents of soils in the fire affected (burnt) and unaffected (unburnt) areas in the dry deciduous forest and completely burnt, partially burnt and unburnt areas in the West Coast tropical evergreen forest were determined. The soil moisture contents were also measured. There was significant difference in many of the soil properties between burnt and unburnt areas. Soil moisture content in the unburnt areas was very high compared to other areas. Soil fertility was the discriminating factor between burnt and unburnt areas in the dry deciduous forest while soil texture, alkalinity and fertility were the three factors which discriminated between completely burnt, partially burnt and unburnt areas in the West Coast tropical evergreen forest. The overall results indicate that ecosystem has not recovered even after several years of occurrence of fire with respect to soils.

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TV–13 IMPROVEMENT OF SEEDLING ESTABLISHMENT AND CLONAL PROPAGATION CAPACITY OF KARANJA (PONGAMIA PINNATA. PIERRE) FOR SUCCESSFUL PLANTATION IN DIFFERENT STRESS SOILS THROUGH MICROBIAL APPLICATION- A NEW BIOTECHNOLOGICAL APPROACH

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Pongamia pinnata (Pierre) belonging to family Fabaceae, is an important evergreen, oil yielding medicinal tree species found commonly in the forests of Orissa. The plant known for its high oil yielding value having great commercial use in leather dressing, soap making, lubrication etc, as well as for medicinal purposes for treatment of rheumatism and skin diseases. Of late the plant is used for biofuel production having great potentiality to replace fossil fuel which warrants need for its mass propagation through afforestation. Thus necessociates the requirement of large scale plantation of the plant in wide range of soil and environmental condition that exist in Orissa, as good fertile soil used for crop land is generally not available for large scale plantation. Application of beneficial microbes like N_2 fixer and P solubilisers are known to improve plant growth and vigour. The present work deals with an attempt to improve seedling establishment and clonal propagation capacity of P pinnata in different stress soils viz. chromite minewastesoil, fly ash and laterite soil compared to Alluvial soil under nursery condition through application selected Rhizobium and AM fungi (Glomus mosseae and Glomus fasciculatum). Results indicated that out of 4 soils tested responses of P.pinnata in terms of shoot length, root length, plant biomass as well as nodulation responses was best in Alluvial soil followed by laterite soil. There was significant reduction in growth parameters of Pongamia pinnata in fly ash as well as waste mine soil. All types of treatment improved the growth parameter independently. However the degree of stimulatory impact varied with soil type. Out of 3 microbes tested Glomus mosseae is more pronounced in all as well as in stress soil condition. The responses of Rhizobium application is more pronounced in laterite soil in improving nodulation capacity. Treatment with Rhizobium also improved growth and nodulation capacity of P.pinnata in mine soil and fly ash bringing to the level of growth responses in alluvial soil. In another separate experiment, application of Rhizobium and G. mosseae was also seen to improve rooting as well as clonal establishment capacity of Pongamia pinnata having synergistic effect along with IBA and IAA treatment. Combination of auxin and microbes showed significant synergistic effect with improved clonal propagation capacity of stem cutting in all parameter taken. However there was a differential response to hormone treatment with combination to microbial inoculation for improvement where IBA treatment improves shoot length, leaf area and nodule number of P.pinnata. IAA combination enhanced plant biomass and root length better. It can be concluded that selected Rhizobium and AM fungi (G.mosseae) was effectively applicable to the seedling establishment and clonal propagation capacity of P pinnata, which will be helpful for successful plantation.

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TV–14 LITTER DECOMPOSITION PATTERN OF THREE ERYTHRINA SPCIES (*E.VARIEGATA*, *E. SUBUMBRANS* AND *E. SUBEROSA*) IN THE SEMIARID ECOSYSTEM, MADURAI, INDIA

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In situ decomposition of leaf litter of *E. variegata*, *E. subumbrans* and *E. suberosa* was studied in semi-arid ecosystems, Madurai, India for a period of 360 days using the litterbag technique. The rate of decomposition, rate of nutrient mineralization and influence of environmental factors on decomposition were studied. The dry weight losses of litter were 97.95 for *E. variegata*, 94.4 for *E. subumbrans* and 90.7 per cent for *E. suberosa*. *E. variegata* decomposed rapidly compared to the other two species. However, the decay rate of the three species of litters did not vary significantly. The decomposition constants value (k) was high in *E. variegata* (k=3.86) followed by *E. subumbrans* (k=2.87) and *E. suberosa* (k=2.38). The mean relative decomposition constant (R) value was found maximum at the final stage of decomposition. *Erythrina* had higher concentration of nitrogen, phosphorus and carbon. *Erythrina* leaves also had high P concentrations. Carbon release was in correspondence with the weight loss. There was no apparent net immobilisation of N observed. Phosphorus had a leaching phase at the early stage of the study. Other nutrients (K, Na, Ca, and Fe) also had significant correlation with the per cent weight remaining ($P<0.001$). Weight loss was positively correlated with litter moisture content as well as cumulative rainfall. Soil moisture was observed to be one of the controlling factors for weight loss and nutrient release, whereas, the air temperature and the soil temperature had any apparent influence over the decomposition process. A linear relation was found to be highly significant between relative humidity (%), pan evaporation (%) and mass loss ($P<0.001$). Hence, *Erythrina* had higher decomposition rate and higher rate of N release in the soil under semi-arid condition. The results suggest that farmers can incorporate the selected *Erythrina* tree leaves to build up organic matter status to enhance soil fertility.

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TV–15 SOLUTION TO THE PROPAGATION PROBLEM ENCOUNTERED IN *TERMINALIA CHEBULA* RETZ. AND *TERMINALIA BELLIRICA* ROXB

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The fleshy fruit of *Terminalia chebula* and *Terminalia bellirica* is a drupe enclosing a single seed. This drupe has its exocarp and mesocarp fleshy and can be depulped. But the inner layer- the endocarp, is hard and stony. Most of the propagation studies reported are with the "functional seed" which is the endocarp enclosing the seed and not with the "true seed". In order to clarify this problem met in the literature, we studied the seed morphology in these two species in detail and found that the endocarp can be carefully broken to release the seed which is covered by a papery thin seed coat. This seed hardly required 8 days (*T. bellirica*) and 20 days (*T. chebula*) for 100% germination under normal conditions. However, Kinetin, KNO_3 and Thiourea could hasten the germination process in these two species. In *T. chebula*, Kinetin (0.005mM), Thiourea (65mM) and KNO_3 (10mM) proved very effective taking 6 days for 100% germination. And in *T. bellirica,* Kinetin (0.05mM) and Thiourea (15mM) effected 100% germination in 4-5 days.

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TV–16 DECLINE IN SOIL PRODUCTIVITY ASSOCIATED WITH PLANTATION FOREST ECOSYSTEM IN KERALA

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A study was carried out in the South Indian Moist Deciduous forest and teak plantations belonging to two age groups viz. 21-30 and 31-40 years in the Vazhachal Forest Division, Kerala to assess the decline in soil productivity. Within each age group, two plantations were selected. Surface soil samples were collected in proportion to the area in teak plantations and made in to composite samples. From the natural forest, five composite samples were collected. The soil samples were analysed for gravel, particle-size separates, bulk density, particle density, pore space and water holding capacity, pH, exchangeable bases, available phosphorous, sodium, potassium, calcium, magnesium, total nitrogen and organic carbon. The soils in the natural forest were clayey loam, while those in teak plantations were loamy. The mean

values for gravel, clay, water holding capacity, K, nitrogen, organic carbon and C/N in the natural forest were greater than those teak plantations. The values were also found to decrease with age of the plantations. Bulk density, particle density, water holding capacity, organic carbon and C/N values differed significantly between vegetation types. The nutrient index values for sand, bulk density, particle density and Ca were high in teak plantations, whereas those for gravel, silt, clay, pH, particle density, pore space, maximum water holding capacity, organic carbon, and exchangeable bases, N, P, K, Mg and Na were low when compared with natural forest. The nutrient index values for gravel, sand, and pore space, water holding capacity, sodium, calcium, nitrogen, organic carbon and C/N were found to decrease with the age of plantations. The study revealed that there is decline in soil productivity along the teak plantations when compared with natural forest.

TECHNICAL SESSION - VI

CONSERVATION AND MANAGEMENT OF FOREST BIODIVERSITY RESOURCES

TVI–01 *EX SITU* CONSERVATION AND PRODUCTIZATION OF NATIVE PLANTS

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Biodiversity is an important resource of the less developed nations in the tropics. It is as yet an untapped chemical and genetic goldmine and a source of innumerable products capable of contributing to the wealth of the nation. It is particularly so in countries like India and China where cultural diversity overlaps biodiversity and historical continuity and traditional wisdom of sustainable bioresource use exist. It is in the interest of these nations that bioresources are documented, conserved, scientifically evaluated, value added and sustainably utilized. As traditional exporters of raw materials, the developing countries are not significantly benefited, however heightened the demand may be for the primitive genetic resources. Technology intervention is essential to achieve the twin objectives of bioresource conservation and productization for economic application. Fortunately, India figures among the few developing countries which has developed the necessary biotechnological competence for adding value to the resources.

Table I . Biotechnological competence of the developing countries

1.	Countries with good biotechnological competence	Brazil, China, India, South Korea and Mexico
2.	Countries that have created the necessary frame work for applying biotechnology	Indonesia, Malaysia, Philippines, Thailand, Ivory Coast, Argentina and other South American countries
3.	Countries that have no research infra structure and are dependent on finished biotechnological products	Mainly African countries South of Sahara, Sahel countries, Ghana, Nepal, Bangladesh

India is a megadiveristy country harboring 45,000 plant species of which 17,000 are higher plants. Around 30% of the active ingredients used in modern medicine today are derived from or related to plants. Many plants are also a rich source of value-added dyes, pigments, oils, perfumery compounds, nutraceuticals, cosmeceuticals, food colures, flavor compounds etc. Yet only about 5% of the earth's more than 2,50,000 flowering plants have been scrutinized scientifically for medicinal and other uses. It is more so in bacteria and fungi that abound in tropical soil but have not been even documented properly. The rich genetic diversity of the Indian micro and macro flora is one of India's strengths and bedrock for future bioindustrial applications.

Prospecting of phytodiversity in India is an urgent need as nearly 27,000 hectares of forestland are lost annually. The country figures among 28 countries that lose biodiversity steadily and the remaining forest tracts are getting degraded in one way or other and species of economic importance over collected. Due to the

very same reasons of endangerment and non-availability of plants from wild lands for drug preparation, bioproduction of medicinal compounds using tissue and cell cultures is equally important. In fact, in many instances bioprospecting may facilitate bioproduction of the newly identified bioactive substance. Though contributions of Indian scientists in tissue culture research are well recognized they are not particularly focused towards bioproduction. Thrust given to bioprospecting and bioproduction research would ensure conservation and sustainable utilization of native plant resources within the provisions of international instruments like Convention of Biological Diversity. It should be noted that the renowned plant wealth of India had never been scrutinized keeping in mind the economic wellbeing of our people. Elsewhere however, several plant specific molecules have been commericialized through biotechnological means.

Table 2. Products produced at industrial scale by plant tissue cultures

Product	Species	Company	Country
Shikonin	*Lithospermum erythrorhizon*	Mitsui	Japan
Berberine	*Coptis japonica*	Mitsui	Japan
Digoxin	*Digitalis lanata*	Boehringer	Germany
Rosmarinic acid	*Coleus blumei*	Nattermann	Germany
Geraniol	*Geranium spp.*	Kenebo	Japan
Purpurin	*Rubia akane*	Mitsui	Japan
Ginseosides	*Panax ginseng*	NittonDenki	Japan
Phytovanilla	*Vanilla planifolia*	Exergenetics	USA

All over the world, about 34000 higher plant species are under various levels of threat. In India, currently having 16.2% of the world's population and ~2.7% annual population growth particularly in biodiversity rich areas, remarkable increase in material needs of the people has exerted pressure on forests 95.5% of which are open. About 1500 plant species are placed under endangered category. The country faces several challenges in the conservation front. In other countries like Australia and USA hundreds of species are subjected to special recovery programmes and more than 400 species have been stabilized through various recovery processes. In the USA, at least 15 different species have been delisted from the red list because of the recovery programmes. The Australian network of botanic gardens together with Government agencies have accomplished the same in more than 100 species. Tropical Botanic Garden and Research Institute probably is the only Institute currently handling this subject in India. So far at least 40 different species have been successfully multiplied through conventional and non conventional means and restored in selected forest habitats in the windward side of the Western Ghats. The need for employing biotechnology-based approaches as crisis management tool for achieving practical conservation of selected species was realized as early as 1985 and the species that were successfully multiplied through embryo and tissue cultures and reintroduced into native / alien

habitats include the Blue Vanda of Asia, *Vanda coerulea, Paphiopedilum druryi, Ipsea malabarica, Adhatoda beddomei, Decaelepis arayalpathra, Blepharistemma membranifolia* and *Calamus nagabettai*. The species successfully multiplied *in vitro* and demonstrated to show high frequency establishment after reintroduction back into nature are presented in Table III. The results suggest that *in vitro* technologies hold significant potential and can be fielded into service to secure practical conservation of all the endangered species of India.

Table III Flowering plants of India successfully multiplied *in vitro* and established in forest segments of the Western Ghats through reintroduction by Tropical Botanic Garden & Research Institute

No.	Species	Reintroducton/ Translocation	Establishment after one year (%)
1.	*Ipsea malabarica*	Silent Valley Ponmudi	74
2.	*Papilionanthe subulata*	Silent Valley Ponmudi	43
3.	*Vanda spathulata*	Ponmudi	62.5
4.	*Aerides crispa*	Ponmudi	47.2
5.	*Anoectochilus elatus*	Ponmudi	49
6.	*Smithsonia maculata*	Karamana river basin	53.75
7.	*Vanda coerulea*	Ponmudi	85
8.	*Aerides maculosa*	Ponmudi	44
9.	*Dendrobium heterocarpum*	Ponmudi	15
10.	*Calophyllum apetalum*	Palode	91
11.	*Celastrus paniculatus*	Kallar	82
12.	*Blepharistemma membranifolia*	Sacred Grove	88
13.	*Morinda umbellata*	Kallar	78

No.	Species	Reintroducton/ Translocation	Establishment after one year (%)
14.	*Acorus calamus*	Palni Hills	92
15.	*Heracleum candolleanum*	Palni Hills	92
16.	*Mahonia leschenaultii*	Palni Hills	90
17.	*Decalepis arayalpathra*	Kallar	84
18.	*Calamus travancoricus*	Aryankavu, Peppara	89
19.	*Calamus nagabettai*	Peppara, Aryankavu	80

The Global Strategy for Conservation formulated by the Botanic Gardens Conservation International, UK has established 16 clear targets for the year 2010. Target No.3 calls for the development of appropriate *ex situ* conservation models with protocols for practical conservation of identified species. Although provision of *ex situ* refugium, multiplication, reintroduction and restoration are only a secondary option to be undertaken after the loss or degradation of the primary resource, the wild population or habitat, it is needed as an important conservation tool in respect of individual critically endangered species. *In situ* conservation is practically insufficient for this purpose as hardly 4.5% of the natural forests are protected, biotic pressures on economic wild species continue unabated and intrinsic barriers for natural multiplication in certain other species are not even understood. In such cases embryo rescue and tissue culture technologies as proposed to salvage and multiply the RET species and introduce them back into natural localities to build up a meaningful population of each species is well appreciated. Biotechnology intervention not only provides an alternative source of species but also guarantees the survival of the existing populations of the species in nature and enhances its population through reintroduction and restoration. There is little doubt that successful translocation of threatened species like the already demonstrated is the absolute test for plant conservationists, as it entails breeding of the species in exile and understanding of the specific ecological requirements of the species for successful establishment in the wild.

Much was said only about plant conservation during 1980's and 90's though achievement in practical terms is largely questionable. But today, conservation and sustainable utilization of native plant resources are inseparably associated. It goes without saying that conservation, prospecting, cultivation, processing, productization and marketing go together as a package for achieving sustainable utilization. Available lands remain the same while the demand increases. Therefore as part of the strategy for sustainable utilization of native plant resources, identification of prospective species, chemical and molecular profiling of the species to

identify the most useful genotype, large scale multiplication of the identified genotypes to increase cultivation, development of packages for cultivation and post harvest processing, extraction of useful molecule(s), formulation / product development, packaging, market scanning including the value of the marketable product and identification of viable market outlets are important components of a successful bioindustrial venture. As such, productization is a multidisciplinary endeavor where enormous scope for employing traditional knowledge, molecular diagnostic tools (RAPD, AFLP, ISSR) phytochemical and pharmacological assys, tissue culture, bioproduction and pharmacy exists. The world-wide demand for phytopharmaceuticals and nutraceuticals is in the order of US $ 170billion and US $ 20 billion respectively. Apart from such candidates as antibiotics, carotene, phycocyanins, DHA, ganoderma specific nutritive products and industrial enzymes which are mostly of bacterial, algal and fungal origin,value added products are seldom forthcoming from higher plant sources in India. The sequential steps involved in productization from a phytopharma company's point of view are presented below.

- Starts from known uses of herbs from traditional medicine and its identification of botanical species and genetic variations.
- Development of micropropagation and cultivation systems for the herb
- Large scale cultivation of target herbs cells or roots
- Extraction of active ingredients in pure form or as standardised mixture.
- Finally conversion to dosage form for easy use by the consumer.
- Examples: *Turmeric* is converted to pure Curcuminoids used in pharma, *Black pepper* is refined to Piperin for use as bioenhancer, Digitoxin from *Digitalis* for heart ailments, Quinine from *Cincona* for Malaria, Reserpine from *Rauwolfia serpentina* for Hypertension.

After the release of two scientifically validated ayurvedic drugs viz JEEVANI and SISOIROPS into the market, TBGRI is currently embarking on the development of half a dozen products out of the native phytodiversity. These include biotechnology mediated bamboo seed production, a wound healing elixir from *Plumbago rosea* hairy roots, a benzaldehyde exract from *Hemidesmus indicus* root cultures useful in flavour and cosmetic industry, camptothecin an intestinal cancer drug from the shoot cultures of *Ophiorhiza* sp and hypericin, an antiretroviral compound from the shoot and cell cultures of *Hypericum* sp. Elsewhere in Indian laboratories, development of novel enzymes and genes from higher plant species has been demonstrated (in box below)

Stress tolerant genes

A gene tolerant to extreme cold temperature from a plant species of the Spiti valley of Himachal Pradesh has been identified, isolated, sequenced and cloned

Salt tolerant genes Betaine Aldehyde Dehydrogenase (BADH), Superoxide dismutase (SOD), Lipid transfer protein (LTP) and Glyoxalase I (Gly 1) have been isolated from the mangrove species Avicennia marina. Transformation of Tobacco and Brassica already achieved with constructs containing BADH, SOD1, LTP1 and Gly 1. Transgenic plants (Ro generation) overexpressing BADH showed increasing tolerance with exogenous supply of betaine aldehyde Novel Enzymes

A novel antioxidant enzyme (SOD enzyme) from a plant species of the Western Himalayas has been identified and purified. It retains its activity after autoclaving and is catalytic at sub-zero temperatures. The enzyme may find applications in medicinal, cosmetic and food industry

It appears the bioindustrial revolution in India has just begun largely fuelled by the liberalized industrial climate, availability of R&D funds, venture capital and proactive policies of the Union Government. But we have to go a long way to consolidate the gains and show leadership in this emerging area.

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TVI–02 SUSTAINABLE USE OF NON-TIMBER FOREST PRODUCTS AND CONSERVATION OF FOREST BIODIVERSITY THROUGH PARTICIPATORY MANAGEMENT BY STAKEHOLDERS:

SOME PRELIMINARY OBSERVATIONS

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Participatory management is considered to be an effective mechanism for the conservation and sustainable use of natural resources, globally. Considering the significant role of stakeholders in preserving and managing the forest biodiversity, a study was undertaken in Wyanad Wildlife Sanctuary (WWLS), Kerala for assessing the causes, magnitude and intensity of commercial extraction of Non-timber forest products (NTFP), which is the major forest resource exploited in the area. The paper discusses the various issues of commercialization led NTFP extraction and the role of participatory management in improving the scenario. The main objectives of this paper are: (1) to highlight how commercialization and associated over-extraction, result in serious erosion of the Non-timber forest products and consequent loss of biodiversity and (2) to indicate how participatory management of NTFPs by the stakeholders would help to prevent the situation. The study targeted the primary stakeholder group of Kattunaickens

who is the primitive tribal group residing in WWLS. It was observed that, extraction of NTFPs is a function of the socio-economic status and attitude of the gatherers and the prevailing market and institutional factors play a significant influential role in deciding it. The underlying ecological and economic dimensions of these factors determine the sustainable use of the species, in the long run. The livelihood status of Kattunaikkan group falls below poverty line and the labour they employ to collect the NTFP species is an act of distress duty rather than an income generating activity, as the opportunity cost of labour is very low in the area. This is reflective of the market, economic and social anomalies existing in the area, triggering an unsustainable extraction pattern of NTFPs, which causes irreversible biodiversity losses.

Ironically, though the absolute values of quantity collected and collection charge given to the tribes projected an increase over the years, it showed a decelerating pace. Coupled with low returns per unit effort, this has serious implications on the sustainability of NTFPs and the forest biodiversity. This could be attributed to the insufficient income from NTFP collection along with the declining money value, which could not sustain the gatherers, culminating in deterioration of their socio-economic conditions. In the context of inadequacy of the present management system of NTFPs in addressing the forest biodiversity loss, a new participatory management programme involving the stakeholders, was formulated for a selected hamlet of Kattunaickens, on an experimental basis, to assess its impact on economic and resource fronts. The participatory management programme implemented was rooted in two assumptions: (1) there exists a close linkage between ecological and economic systems relating to NTFPs and (2) sustained income is one of the pre-requisites for the success of the management.

The study conclusively suggested that, for the success of participatory programme, the area selected should be need based and the participating communities, be homogenous. Resource availability in the forests (enrichment planting, preservation of gene pool area, species substitution in the harvesting regimes, etc.) and income enhancement of the stakeholders (open market sale, value addition, species substitution, etc) were given thrust in the participatory management programme. The programme also attempted to impart training and awareness creation among the stakeholders for a better conservation scenario and sustainable utilisation of NTFPs. It was observed that the higher the income and benefit sharing, the higher the participation of the stakeholders, indicating a perfect positive correlation between these factors. The study results suggest that effective implementation of NTFP based participatory management programme would enhance the income of the stakeholders, thereby uplifting the socio-economic status. This would result in sustainable extraction and use of NTFPs, which is imperative for conservation of forest biodiversity in the study area.

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TVI–03 CONSERVATION OF ESSENTIAL ECOLOGICAL DIVERSITY AND LIFE SUPPORTING SYSTEM

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Derogatory activates on natural habitats for reasons such as mining, industries, urbanization and other developmental activates and manipulation over most of the wilderness of the global ecosystem by men have been facing many species to be extinct or endangered to jeopardize the future of earth as a living planet. Forests are vanishing at the rate of 17 million hectares per year and about 140 species of plants and animals are condemned extinction each day. Furthermore, indiscriminate use of fertilizers, biocides, relentless release of toxic industrial effluent and obnoxious gases including green house ones, emission of radioactive substances, soil erosion, improper land-use, cultural eutrophication of the water bodies have been wiping of many diversities in nature. Liquidation of biophysical capital by conversion natural ecosystem into biotic communities with low or no diversity as in agroecosystem, monoculture forestry and subsequent rise in the requirement of maintenance energy and sharp fall in productivity have proved to be detrimental particularly so in tropical ecosystems. Thus, biodiversity "the library of life" is on fire. This fire must be extinguished before biological resources yet to be discovered are lost beyond recovery.

The adverse effects of human relations with biodiversity are increasing dramatically and threatening the very foundation of sustainable. Loss of biodiversity resources and their diversity threatens our food supplies, sources of food, medicine and tourism and interfere with essential ecological functions. The importance of biodiversity has been promoted by the International Convention on Biological Diversity, part of the earth Summit held in Rio de Janeiro in 1992.

Biotic resources represent the very essence of life on the earth and every thing that is possible should be done to preserve the biological diversity. There are two basic approaches of the biodiversity conservation; *in situ* is the conservation within their habitat such as Protected Areas, Biosphere Reserves and Hotspot. A traditional strategy is also existing in India and some other Asian countries for conservation of scared forest and sacred lakes where as but the *ex situ* museums, herbaria or zoos. The collections of living material in the form of zoo, animal's botanical gardens and seeds, together with DNA collections have been termed gene banks. Plant species and crop varieties can be easily stored in seed bank.

Other important steps for biodiversity preservation to develop programme by Governmental and Non Governmental organization to register local information innovation related to genetic resources as well as natural resource management. It must be duties of each human being that they preserve biodiversity otherwise the global environmental future will not permit human survival on the living planet earth.

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TVI–04 REPRODUCTIVE BIOLOGY OF *IMPATIENS HENSLOWIANA* ARN.: A WILD ORNAMENTAL BALSAM OF WESTERN GHATS

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Balsams are beautiful plants bearing curious and variously coloured with peculiar floral structures. They belong to the genus *Impatiens* Linn. of family Balsaminaceae, which is one of the largest group among flowering plants comprising about 900 species. In India, the genus is represented by 200 species and mainly distributed in three major centers of diversity ie., Western Himalayas, Hills of north Eastern states and Western Ghats. Out of 92 species available in peninsular India, 80 are endemic and confined to Western Ghats. Though the ideal climatic conditions prevailing in the Western Ghats region provide suitable habitat for the balsams, the population is rapidly declining due to various factors such as habitat degradation, fragmentation of populations, anthropogenic pressures, reproductive constraints etc. Reproductive inefficiency may also lead to rarity of species in certain cases. Inspite of their ornamental potential and conservation importance, only few attempts were made to study reproductive biology of balsams. Therefore, a study on the reproductive biology of one such balsam namely *Impatiens henslowiana* was carried out to find out possible reasons for its limited distribution in Western Ghats.

The study covers phenology, floral morphology, pollination biology, pollen-pistil interactions, propagation methods etc. *I. henslowiana* flowers between July and December with maximum flowering in September. The flowers are large and white, sweet scented and open between 9.30 pm and 5 am. Anther dehisced one day before anthesis which conformed the protandrous nature and reproduces by means of cross pollination. Each flower produced an average of 38, 250 pollen grains and 22 ovules. Thus pollen ovule ratio is 1738:1. *In vitro* study on pollen germination indicated that 98% were germinated and developed tube up to 1313 ìm in Brewbakers medium conformed its viability. Maximum stigma receptivity was noticed during first day of anthesis with 55% *in vivo* pollen germination. Pollination is effected by honeybees, bumble bees, beetles, butterflies, ants etc. The rate of fruit set is 78% and 81% by open pollination, xenogamy and geitonogamy respectively. However, seed viability is only 30%. Its poor population in the wild is mainly because of habitat loss, narrow environmental niche, low percentage of seed germination etc. All these causal factors either singly or in combination with others are responsible for the limited distribution of *Impatiens henslowiana* in the wild. Therefore vegetative propagation method had been standardized by using stem cuttings for propagation and reintroduction purpose with the objective of establishing viable populations in the wild.

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TVI–05 COMMUNITY CONSERVATION OF HEDGE PLANT DIVERSITY

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Among the traditional management practices of ecosystem role of hedge plants especially in rural areas should be considered to contribute significantly to conservation of biodiversity. Most of species which are capable of thickly growing and drought resistant with some properties of medicinal values, but not grazed by cattle were traditionally grown along the borders farm houses, plantation fields and along residential areas. Hedge plant represents a borderline flora, which is maintained traditionally and selectively for their fast growth and economic value. Ecological service rendered by hedge plants include soil conservation, acts as a wind breaks, recharging the ground water table and offering protection to seedlings from scorching sunrays and also supports subsequent trophic levels. Hedge plants are used as biocontrol agents of insects, pests and to trap the air pollutants. These plants offer as barriers for the cross pollination. Fence built of steel, cement, pillars can provide only protection to crops from grazing animals but not conservation. Apart from ecological services, they also have economic value, a source of income to the forming community. The hedge plants serve as a source of flowers, fruits, medicine, fiber, timber wood, fuel wood, and green manure, insect repellent. Comparative study of forest vegetation near by area reveals that most of the species exist as hedge plans only. Further, faiths and beliefs play major role in variation of hedge plant across the space. Spatial variation in hedge plant diversity and its traditional community conservation practices have been discussed.

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TVI–06 TRADITIONAL MANAGEMENT PRACTICES OF LOCAL FARMERS IN SUSTAINABLE UTILIZATION OF SOPPINA BETTA FORESTS IN SRINGERI AREA OF WESTERN GHATS, INDIA

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Soppina Betta forests (SBFs) are minor forests allocated by the state government to the *Areca* growers in the Western ghats area of Karnataka to derive the organic resources. This practice of sustainable utilization of SBFs minimizes the pressurization on natural forests (NFs) of the area. Ten hamlets in Sringeri area were selected at random and totally 106 farmers were interviewed by participatory rural appraisal (PRA) technique to gather informations regarding purpose, benefits and management of

SBFs through their traditional ecological knowledge. One representative SBF from each of the ten hamlets was taken up for phytosociological studies and one natural forest of the area considered as benchmark. The results were analysed by using multivariate analysis and principal component analysis (PCA). Interestingly, NF and SBFs separated at the coarsest linkage in ward's dendrogram suggesting that the two systems are compositionally different. But species diversity and stand densities at all levels were higher in the SBFs than in the natural forest. The farmers were found to promote selected species like *Aporosa lindleyana*, *Memecylon umbellatum*, *Syzygium cumini* and *S. caryophyllatum* for their foliage requirements. The benefits derived, lopping patterns, protection and planting attributes of the farmers were marked with a differentiating scheme based on their importance and impact on SBFs and relative scores on these four heads of management attributes were summed up into Management value Index (MVI). MVI values of all the farmers lies between 0.6 to 0.8 which reflect the sustainable management of SBFs. MVI was found to increase with the *Areca*- landholding status of the farmers, and optimization of the MVI was observed at an Areca landholding to SBF ratio of 1:1.5-2.5 for the low, intermediate and large scale Areca-landholding categories. The optimization was most pronounced for the low landholding group of farmers. Good correlation have been observed among the pairs of variables like SBF holding and litter collection, total land holding and fuelwood etc. All these observations show that the management practices of local farmers keep the SBFs in good stance.

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TVI–07 STORAGE STUDIES IN *DALBERGIA SISSOO* (ROSE WOOD) SEEDS

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Dalbergia sissoo, commonly termed rosewood is a very important timber yielding tree growing widely in the tropics and sub-tropics. The tree produces abundant seeds during the winter months (January and February) in northern India. Although conservation of woody species is best achieved through arboreta and field genebanks, the future tree improvement programmes depend solely on seeds. Therefore, conservation of seeds as a complementary strategy is important. Methods for medium or long-term conservation are not available for this species. The present study was undertaken to understand the storage behavior of these seeds and device appropriate protocols for their conservation

Physiologically mature brown pods collected from profusely fruiting plus trees were pooled and the seeds were extracted. The seeds were conditioned to various moisture contents *viz* 1.7, 2.3, 7 and 10 per cent and several sub-lots with each moisture content were packed in laminated aluminium foil packets for storage at room temperature, 4^{o}C and –20^{o}C. The sub-lots were monitored at an interval of six months for their viability and vigour.

Results of four years storage revealed that the seed lots conditioned to low moistures of 1.7 and 2.3 per cent and stored at room temperature began to show losses in viability, before the seed lots at higher moisture, registering 30 and 40 per cent germination respectively. However, the ultra dried seed lots when stored at + 4 and –20°C registered, more than 75 per cent germination. Although ultra-desiccation, followed by ambient storage, is considered to be a cost-effective storage technology for most of the field crops, due to their purely orthodox nature, it did not prove to be a promising technique for extending the viability of the species under investigation.

The storage behavior and the moisture and temperature requirements for the medium and long term storage of these seeds are discussed.

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TVI–08 SACRED GROVES: VALIDITATING THE CULTURAL CONNECTIONS TO CONSERVATION OF BIODIVERSITY

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Ever since the adoption of convention on Biodiversity (CBD), diverse attempts have been made to identify, document and conserve biodiversity. Research on Sacred groves has gained momentum since then since these are patches of natural vegetation preserved dedicated to local deities and preserved with religious fervour. They are examples of the ecological wisdom of ancient societies and the strategy of ascribing religious and cultural traits reflects their psychological approach to an essentially environmental issue.

This paper examines the origin, prevalence and perpetuation of the groves as well as the reasons for their decline with emphasis on the bio-ethical and cultural connections.

The Pioneering work of Professor Madhav Gadgil who first made a systematic analysis of the groves on the Western Ghats, has also highlighted the cultural and religious manifestation associated with them. The anthropological dimension has invariably emphasized the human-nature interface that was expressed by different societies inhabiting different geographical areas. Despite the differences in the customs, rites and rituals, what was discernible was inextricable faith of ancient societies on nature and their explicit desire to express their gratefulness.

Tracing the history of sacred groves has provided evidences for the strong bond between the man and his environment. Starting from the hunter-gatherers up to modern societies all societies entering primitive cultivation shifting cultivation and settlement agriculture have maintained the perceived linkage and perpetuated the variety of cultural manifestations.

An inevitable corollary of this concept is the conservation of biodiversity – especially that was exclusive to the region adjacent to the human societies. The prevalence of sacred groves in different

phyto-geographical zones, thereby conserving diverse plant formations is a point in proof. They are numerous in the mountain ranges of Himalayas, North-Eastern Hills, central India, East and Western Ghats. Apart from hill ranges wherein the ancient tribal communities are still surviving, these are recorded from the leeeward regions of Aravalli mountains; typical of arid regions, the groves have drought – tolerant thorny species as principal components.

Resource constraints, population pressure propelled the ancient societies confined to the remote areas to migrate to the plains. As agriculture was the prime vocation of the migrants, clearing of forests and the attendant practice of preserving a piece of forest as sacred grove perpetuated. While this facilitated the perpetuation of concept and its spread to the plains, the Vedic culture had an adverse influence. The cultural dimensions ascended and the concern for conservation declined. This has east a gloom on the diversity of the biota and accentuated their decline.

Despite the shortcomings, reports from various parts of India have confirmed the conservation values of the groves. Be it a small cluster of a few trees like Panchavati or a vastly expansive tract of hundred of acres on mountains, there is no gainsaying the fact that cultural twist given by the ancient societies to conservation initiative, has largely succeeded.

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TVI–09 PEOPLE'S PARTICIPATION IN BIODIVERSITY CONSERVATION

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India is one of the 12 mega biodiversity countries of the world with 2 of the 18 hot spots world wide. This diversity is due to diverse types of ecosystems, high species diversity, high incidence of endemism and enormous diversity in crop plants. India harbour 11 percent of the world flora in just 2.4 percent of the land area. Over 4.66 percent of the country's biodiversity rich areas have been earmarked for extensive in situ conservation of habitats through protected area net work. Serious efforts are also being made to conserve this wealth under ex situ programmes. Threat to biodiversity can be minimize by sustainable use. People's awareness and participation, is the important key in achieving required conservation. Whenever we consider biodiversity, humans are kept out of the boundary of the ecosystem. Eco-development and people's participation is an integral part of any conservation initiative. The implication of this approach often leads to a drastic change in our perceptions of ecosystem function and sustainable management of biodiversity with people's participation. The International Geosphere Biosphere Programme (IGBP) and the International Human Diamensions Programme (IHDP) dealing with biophysical issues and human diamensions of global change biodiversity respectively are an area of concern, as one of the

important components of global change. Linking up ecological with social processes is the key to sustainable biodiversity management. This is an area or research which has just started receiving attention.

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TVI–10 FOREST BIODIVERSITY CONSERVATION THROUGH COMMUNITY SEED BANKS

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Ecological degradation and its corollary - biodiversity loss - pose a serious threat to development. 'Ecologically destructive economic activities are inefficient not merely because of the resulting resource misallocation but also because of the (excessive) scale of activity levels; excessive in relation to the limited availability of natural capital when the latter is complementary to human-made capital' (Foy and Daly, 1989). In order to bring about sustainable resource conservation and management, it is essential to adopt several different approaches for managing our forests and biodiversity.

Future efforts for conservation and management of our natural resources must derive from a set of clear objectives, mechanisms for action, and commitment from all stakeholders. Apart from this, halting the process of degradation and species loss requires specialized solutions and an understanding of ecological processes. Protecting biodiversity does not merely involve setting aside chunks of area as reserves. Instead, all the ecological processes that have maintained the area's biodiversity such as predation, pollination, parasitism, seed dispersal, and herbivory, involving complex interactions between several species of plants and animal needs to be ensured (Terborgh, 1999). This, however, is possible only if reserves are large enough to maintain these processes and some of the other crucial links in the web of life.

There is also the need for greater involvement of communities, and for models, which decentralize of management and conservation roles and responsibilities. As of now, there are still major lacunae in information resources pertaining to forests, biodiversity - flora and fauna, causative factors for their degradation, and major threats. The available data is alarmingly inadequate to provide a lucid picture of the current status and ongoing losses/gains. More importantly, laws and policies governing natural resources are still not sufficient enough to tackle the scale of the problem, and these insufficiencies have not been addressed with a sense of urgency.

In this paper, we discuss about the concept, importance, and steps involved in community seed banks that will help mitigate the disturbingly accelerating biodiversity loss.

TVI–11 DIVERSITY OF THREATENED FLORA IN SELECTED SACRED GROVES OF COASTAL KERALA

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The sacred groves are the "Gardens of Gods" containing natural vegetation of the locality associated with the supernatural power and preserved over a period of time. They are patches of virgin forests preserved and protected by the local people on religious grounds and this is the only forest existing in the coastal region of Kerala. Five sacred groves were selected to study the structure of threatened flora in the Thrissur District. Total of twenty five plant species recorded from these sacred groves, of these highest number of species recorded from Pipoth Kavu (24 species) followed by Adiparambil Kavu and Madambath Kavu (25 species), Kottai Chalipat Kavu and Kalyarakkal Kavu (21 species). The abundance of plant species was higher in Madambath Kavu (388) and lowest in Pipoth Kavu (195). The diversity index (H') was highest in Pipoth Kavu (2.69), Madambath Kavu (2.55), Kottai Chalipat Kavu (2.46), Kalyarakkal (2.39) and Adiparambil Kavu (2.25). The diversity is significantly varied between the sacred groves ($t = 33.33$; $df = 4$; $P = .000$). The sacred groves in essence epitomize an all embracing concept and practice of the ancient Indian way of *insitu* conservation of biological and genetic diversity. They are thus *Sanctum Sanctorum* of rare, endangered and endemic plant species, many of which have disappeared from the region outside the groves. Sacred groves used to be a common feature of every hamlet that was owned commonly by the local communities. Ownership of the groves and the belief of the people on the deities living inside the groves are decisive factors, which decide the conservation of the sacred groves in Kerala. The fact that about 79 per cent of them are small, neglecting the smaller groves will lead to the disappearance of both vegetation and cultural diversity. Therefore, it is necessary to encourage the conservation of the last resorts of existing relicts of natural vegetation in the unforested coastal region of Kerala.

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TVI–12 MANAGEMENT AND POLICY OPTIONS FOR CONSERVATION OF BIODIVERSITY OF NAMDAPHA NATIONAL PARK IN ARUNACHAL PRADESH, NORTH-EAST INDIA

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Protected area management shows consistent patterns of strengths and weaknesses around the world. Anthropogenic disturbances at different scales cause destruction to the plant and animal habitats. The impacts of such disturbances have been the centre of focus of biodiversity and conservation as well as ecological research in the recent years. The Namdapha national park (1985 km^2 with 177 km^2 buffer zone) is

a treasure house of endangered, wild relatives of cultivated, and rare and interesting plants (e.g. *Camellia caudata* (wild tea), *Coffea benghalensis* (wild coffee), *Mangifera sylvatica* (wild mango). *Gnetum ula* and *Pentasacme wallichi* are extremely rare species reported from this protected area. Different species of root parasites (*Sapria himalayana, Balanophora* spp.) are yet another set of rare species of the park. About 820 angiosperms and 96 species of mammals have been reported from the protected areas. The park is an important refuge for *Hylobates hoolock* (hoolock gibbon), *Muntiacus putaoensis* (leaf deer). *Panthera pardus* (leopard), *P. tigris* (tiger), *P. uncia* (snow leopard) and *Neofelis nebulosa* (clouded leopard), are the globally unique to Namdapha. Nevertheless the inaccessible mountain terrain of Namdapha has also facing under anthropogenic disturbances. Conflicts arise when band of resource use by the communities has been imposed between the management authorities and the local people. Poaching, encroachments for agriculture and settlements have been leading a barrier for better management of the Namdapha national park. The present paper addresses *pros* and *cons* about the management options of Namdapha national park for conservation of biological diversity in the park.

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TVI–13 STUDIES ON THE SACRED TREES AND SACRED GROVES OF VIRUDHUNAGAR DISTRICT, TAMIL NADU

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A Survey on the sacred trees and sacred groves in the three traluks of virudhunagar district namely Sivakasi, Srivilliputhur and Rajapalayam was made. Sacred trees are otherwise called Sthalavirkshas are usually associated with deity of the temple. In Tamil Nadu, most of the ancient temples are always associated with tree. Such trees are usually presented by the people out of fear and religious sentiment. This is also a method of insitu conservation. A small portion of flora and vegetation parts of such trees are also taken away by the people and it is being used as medicines for diseases. Hence a survey was made in three taluks of virudhunagar district on these Sthalavirkshas. It was observed that about 23 temples in Sivakasi, 20 temples in Srivilliputhur and 26 temples in Rajapalayam have sacred trees and sacred groves. The medicinal values are also tabulated.

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TVI–14 UTILIZATION AND CONSERVATION OF FOREST TREE RESOURCES OF EASTERN GHATS OF ORISSA, INDIA

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Eastern Ghats represents a chain of fragmented hill ranges, extending over 1750 km in the state of Orissa, Andhra Pradesh and Tamil Nadu along the East Coast of India. Due to wide range of topography and diversified physical features, it harbour rich and varied flora. The hilly forest areas of Eastern Ghats are mainly inhabited by several tribal communities, who still depend on forest resources for their livelihood. A long before, many part of the Eastern Ghats was once covered with luxuriant vegetation. Clearing of these natural vegetation for human settlements and agriculture has almost wiped out the forest trees from these areas and now their distribution is confined to the hills. Herbal medicines were popularly used in India from time immemorial. As far as the plants used in herbal medicines are concerned, not only the herbaceous and shrubby species, but the trees also play vital role. These forest tree species are used by various people for different purposes such as timber, fuelwood, food and treatment of various diseases. These tropical trees, because of their complex genetic constitution and breeding systems, have lot of natural variations. The genetic diversity and variations in the phyto-chemistry of different populations of trees, which are distributed wide apart or isolated by various barriers, are some of the interesting areas of studies. The present paper focuses some of the important economic and medicinal uses of forest tree species from Eastern Ghats hill ranges of Orissa and also discusses various aspects of conservation of the remnant forest resources before it vanishes.

TECHNICAL SESSION - VII

WILDLIFE / ANIMAL BIODIVERSITY

TVII–01 STATUS AND CONSERVATION OF SOME THREATENED FAUNAL BIODIVERSITY OF ARID KACHCHH, GUJARAT, INDIA

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Assessment of biological diversity has tended to focus on species lists for the areas of interest (alpha diversity surveys), and considerable importance is attached to the magnitude of species richness at the sites and/or to the existence of threatened species. Helpless human needs and opportunistic greediness have resulted into depletion of biotic wealth and large areas of species rich forest are being cleared to make way for agriculture, urban, industrial, transport and other developmental projects leading to habitat fragmentation, population isolation, inbreeding, species extinct and ultimate loss of biodiversity. Unfortunately, detailed inventories in the field are constrained by severe resource and time limitations, further compounded by the accelerated rate of biodiversity loss. This is very true with the species which are already at the verge of extinction as they are threatened.

Kachchh, the second largest district in India, located in the western most end of Gujarat state extends over 45,652 sq. km. Kachchh, being an arid region faced with extremes of climatic conditions harbours its own, unique forms of fauna, with some species being found comparatively in high abundance and endemic to this arid region. The increase greed for land has not spared this district also with the diverse habitats and species facing immense pressure which has led to quite a few species to the brink of extinction. This study discus the status, distribution, threats and conservation strategies for some of the threatened faunal species listed either by IUCN or National RED Data Book. The data on status and distribution of four reptiles, five birds and four mammals were collected by using line transect and strip transects in addition to opportunistic and microhabitat search. The surveys were conducted both in the day and night. Vehicle transects were also done to establish their status. Indirect evidences (scats, pellets, droppings, tracks, dens, burrows or holes, etc.) were also recoded along with their abundance, type of habitat and threats faced.

Out of the four reptiles studied three (Banded Gecko (BK) - *Cyrtopodium kachchhensis*, Desert Monitor lizard (DML) - *Varanus griseus* and Starred Tortoise (ST) – *Geochelone elegans*) were found in low numbers (< 50 individuals) and restricted to only one habitat and reported from <6 locations, while Spiny-tailed Lizard (STL) – *Uromastix hardwickii*) was fairly abundant (>150 individuals) with a total of 1180 individuals recorded from more than 12 locations and three habitats. Among these species, BG was predominantly found in forest areas, while DML and STL were more in open scrub habitats. Starred Tortoise was common in the agro-ecosystem. The problem of habitat degradation was faced by DML and ST at medium levels. Vehicular traffic was a threat at medium level to ST and STL. Poaching and flooding were major threats for STL which was at high level. All the reptile species are highly threatened considering their abundance and the

threats faced. Of the five threatened birds species studied three (Great Indian Bustard (GIB) *Ardeotis nigriceps* - 46, Stoliczka's Bush Chat (SBC) *Saxicola macrorhynca* - 17 and Sociable Plover (SP) *Vanellous gregarious*- 41) were found in low numbers (<50 individuals). Though they were recorded from 5-7 locations and 2-3 habitats they were restricted to western part of Kachchh, with majority or all in a single population. Lesser Florican – LF (*Sypheotides indica*) and Pied Tit –PT (*Parus nuchalis*) recorded moderate numbers (50-<150 individuals) and documented at six and 16 locations respectively. Pied Tit being hole nesting species, it was restricted to only forest habitat, while GIB, LF and SBC were mostly present in Grasslands. Sociable Plover was recorded from agro-ecosystems - agriculture fallows. All these species were with either restricted or patchy distribution. Habitat loss was the major threat faced by all bird species, which was at medium to high level, while grazing was also a major threat to the three (GIB, LF and SBC) grassland dependent species.

Four threatened mammals species were studied, which included two small cats (Caracal- Cc *Felis caracal* and Desert Cat – DC *Felis libyca*), one ungulate (Chinkara or Indian Gazelle – IG *Gazella gazella*) and an insectivore (Long-eared Hedge Hog – LHH *Hemiechinus auritus*). Of these Cc, DC and LHH were less abundant (<50 individual), while IG was found with moderate numbers (50-150 individuals). Though all these mammals were found in 3-4 habitat and 6-22 locations, except for IG (six areas) other three species had restricted distribution, being found only in 2-3 areas. Both the small cats were sighted mostly in open scrub and other forested areas. Indian Gazelle was mainly recorded from grasslands and forest areas. Hedge hog was found predominantly in the open scrub. Habitat loss was the major threat faced by all mammal species at medium to high level, while vehicular traffic was also threat mainly to LHH and DC.

Since most of the species are restricted to grasslands and PT to the thorn forest it is imperative to protect and manage these habitats as part of in-situ conservation in close association and awareness of the local communities. As already a Protected Area (Lala Bustard Sanctuary) of 2km^2 has been notified to protect the GIB, this area must be declared as a sanctuary by adding adjacent grasslands, which would benefit the other grassland dependent species like Lesser Florican, Stoliczka's Bush Chat, Sociable Plover, Spiny-tailed Lizard, Desert monitor lizard, Indian Gazelle, Desert Cat and Long-eared Hedge Hog. Further, PT being found only in thorn forest, and Kachchh encompasses the last remnant of tropical thorn forest, it is important to strictly protect the thorn forests of Narayan Sarovar Chinkara Sanctuary. It is also crucial to elevate the status of protection and management of reserved forests of Dhunai, Mathno-madh, and northern part of Naktharana. It is also very crucial that, all these species need stronger ecological information to plan for their proper conservation and log term survival.

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TVII–02 BIODIVERSITY OF INSECT PESTS OF MULTI-TIER AGRO-FORESTRY SYSTEM

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In the study conducted at the agro-forestry field of the department of forestry, IGKVV, Raipur during August 2004 to May 2005 on multi-tier agro-forestry system consisting of five species viz. Jatropha (Jatropha curcas) ,Mangium (Acacia mangium), Aonla (Emblica officinalis) ,Meethaneem (Murraya koenigii) and Turmeric (Curcuma longa) in which Jatropha (Jatropha curcas) was found to be infested by two species of blue bugs, (Chrysocoris purpureus) and Scutelleria nobilis. Leaf-webber (unidentified), Coccids (unidentified) .Cowbug (Tricentrus bicolor) in Mangium (Acacia mangium). Meethaneem (Murraya koenigii) was found to be infested by caterpillar (Tonica zizyphi), coccids (unidentified), Citrus black fly (Aleurocanthus woglumi), Cowbug (Tricentrus bicolor). Calioptilia acidula in Aonla (Emblica officinalis) and Skipper butterfly (Udaspes folus) in Turmeric (Curcuma longa).

Multi-tier system consists of herbaceous layer along with woody perennials. Generally the herbaceous layer is the lowest layer ground, a tree layer consisting the upper level and intermediate layer in between. The lower layer can be partitioned further into two, with lower most (less than 1m height) dominated by different vegetables, medicinal plants and the second layer (1-3 height) being composed of food plants. The upper tree layer can also be divided into two, consisting of emergent, fully grown timber and fruits trees occupying the next lower layer. The intermediate layer of 3-10 m height can be dominated by various fruit trees, some of which would continue to grow taller (Nair, 1993).

The present studies on Multi-tier agro-forestry system included five species namely Jatropha (Jatropha curcas) ,Mangium (Acacia mangium), Aonla (Emblica officinalis) ,Meethaneem (Murraya koenigii) and Turmeric (Curcuma longa). The layer of shrub was of Jatropha (Jatropha curcas), which was the middle layer along with the lower herbal layer of Turmeric (Curcuma longa) and Aonla (Emblica officinalis) formed yet another layer with Meethaneem (Murraya koenigii) as middle layer. Mangium (Acacia mangium) formed the top most layer.

The experiment was conducted at, the agro-forestry field of the department of forestry, I.G.K.K.V, Raipur during August 2004 to May 2005 The whole field was divided into three plots either diagonally or in a straight line in such a way that each plot contained at least three plants of all the five species. Observations were recorded weekly for different types of insects and number of insects from each plot on randomly selected plants of each species.

Among the five species in multi-tier agro-forestry system the major insect pest recorded in Jatropha (Jatropha curcas) were two species of blue bug were reported namely (Chrysocoris purpureus) and Scutelleria nobilis. Leaf- webber (unidentified), coccids (unidentified) were also noticed. Cowbug (Tricentrus bicolor)

and coried bug Homococerus sp. was also recorded. In (Acacia mangium). Caterpillar (Tonica zizyphi), Coccids (unidentified), Citrus black fly (Aleurocanthus woglumi), Cowbug (Tricentrus bicolor) were the four insect pests found on Meethaneem (Murraya koenigii) while Calioptilia acidula in Aonla (Emblica officinalis) and Turmeric skipper butterfly (Udaspes folus) were the main insect pests**.**

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TVII–03 DIVERSITY OF BIRDS IN THE TROPICAL FORESTS OF KERALA, INDIA

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Throughout the world, tropical forests are rapidly being converted into agriculture and other land use practices. In most of the regions, these forests will survive only in fragments for the next several decades. This paper elucidate on the diversity of birds in the tropical forests of Kerala. The Western Ghats is well known for the rich and unique assemblage of flora and fauna. Kerala State, located between 8^{o} 4' and 12^{o} 48' N and 74^{o} 52' and 77^{o} 37' E is known for its rich biological resources on account of availability of a variety of ecological niches and habitats ranging from topical forests, valleys, plains and coastal areas. The paper is based on field studies carried out at Silent Valley National Park and published literature on the avifauna of southern Western Ghats. Four hundred and ninety three taxa of birds were recorded from the Kerala State, which belongs to 80 Families, under 19 Orders. Out of these, 285 species are residents, 114 were resident migrant, 86 were migrants and eight species were straggler/ vagrant. Out of the 1340 species of birds recorded from the Indian subcontinent, 37 per cent are found in Kerala. Highest number of bird species is reported from the Periyar Tiger Reserve, followed by Wayanad Wildlife Sanctuary. Ninety-nine taxa of birds were recorded from the Silent Valley and Ninety-two taxa from Mukkali. Of the reported species, sixteen species were endemic to the Western Ghats and 29 threatened. The high avian species richness recorded from the State is due to the presence of diverse vegetation types and microhabitats in the State.

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TVII–04 INSECT SPECIES DIVERSITY IN THE NEW AMARAMBALAM RESERVED FORESTS OF NILGIRI BIOSPHERE RESERVE, KERALA, INDIA

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Insect species diversity was studied in representative plots in the New Amarambalam Reserved Forest during 1997-2000. Altogether, 535 insect species belonging to 14 orders and 83 families were collected from the sample plots laid out in different forest types at various altitudes. Of the various forest types, the evergreen forests recorded the highest diversity (4.51) followed by the semi evergreen (4.35), moist deciduous (4.21) and sub tropical hill forests (3.48). In most areas, the dominant insect groups were Lepidoptera and Coleoptera. The richness and diversity of these groups were high in the evergreen forests followed by semi evergreen, sub tropical, moist deciduous and shola forests. The faunal elements contained a high proportion of rare and endemic species. Maximum number of endemic / protected species were recorded in the evergreen forest (20 spp.) followed by semi evergreen forest (15 spp.), moist deciduous forest (7 spp.), sub tropical hill forest (7 spp.) and montane shola forest (5 spp.). Among butterflies, of the 133 species recorded, 28 species were found to be of high conservation status being either endemic / protected species. Although, a complete analysis of faunal elements could not be made for all groups, there were a number of rare species having great aesthetic value like the cicadas Cryptotympana varicolor and Platypleura insignis, the stag beetle Odontolabis cuvera Hope and the colourful saturnids Actias selene Hb. and Loepa sikkima Moore.

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TVII–05 INSECT PHILATELY' A MEANS OF COMMUNICATION OF BUTTERFLY DIVERSITY AND ITS CONSERVATION

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Butterflies are the most beneficial creatures of nature. They are admired for their colour, design and pattern of wings. Butterflies visit flowers for nectar. The rich diversity of butterfly fauna of India has been well documented by Wynter Blyth (1957), Thomas Sathyamurti (1966), Mani (1986). Field guides with descriptive notes and photographs on Indian Butterfly fauna have been published by Gay *et al* (1992), Gunathilagaraj *et al* (1998), and Krushnamegh Kunte (2000). Butterflies are threatened and becoming endangered and extinct due to many reasons of human activities. Of the species of butterflies described in Indian subcontinent, 120 species have been listed in Schedule I and 292 species under II of Wildlife Protection Act (1972) (Modified in 1989) of India. The commonly threatened butterflies such as Bhutan Glory, Common Blue, Apollo, Kaiser-I-Hind, Dragontail, Parnassins, Kallima, Danaus, Cynthia,

Parentica, Common Bird wing are listed in Red Data Book as endangered species. A global awareness has been created for wildlife conservation and protection of Butterflies.

World countries have issued stamps on such rare, endangered and rich diversity of butterflies of their respective countries. So far 293 countries have released 7754 stamps on butterflies as per Domfil Thematic stamp catalogue on butterfly fauna (Anonymous, 2002). There is a world awareness to conserve this fauna. Thematic collection of butterfly stamps by entomophilatelists besides a hobby is a means of communication of diversity of butterfly groups helping to know their species diversity, place of origin, habitat, rarity, endangeredness, migratory behaviour and their significance such as economic importance. Stamps on butterflies are also released on occasions of Environmental Protection and Conservation Programmes.

The families of butterflies on stamps are Papilionidae (Swallow tails, Birdwings), Pieridae (Whites, Sulphurs, Orange tips), Hesperiidae (Skippers), Lygaenidae (Blues, Coppers), Danaidae (Monarch, Danaus, Crows, Tigers), Nymphalidae (Brush Footed, Fritillaries, Admirals, Vanessas, Pansies), Satyridae (Browns, Wood nymphs) and Acraeidae (Costers). The first butterfly stamp issued was on a bird wing butterfly *viz*., *Trioides brookiana* in 1950 by Sarawak a Malaysian province for 1 cent value.

The endangeredness of butterflies are due to threats such as habitat loss and change, invasive species, commercial exploitation such as overcollection of rare butterfly species and those species in the schedule, pesticides pollution, urbanization, deforestation, forest fires, grazing, destruction of butterfly reserve habitat, *etc*. The butterfly conservation management has been well described by New *et al* (1995). Some of the key issues and practical steps of conservation of butterflies include increasing habitat security, intensifying site management by enriching it with food plants and eliminating competitive weeds, increasing their numbers and distribution through *ex situ* measures such as captive breeding and release, butterfly gardens and butterfly ranching *etc.*

Insect philately especially butterfly stamp collections besides a hobby, helps in exploring the rich diversity, its rarity and also acts as a communication tool for many information to the young children and public to create an awareness to conserve and protect this fascinating aesthetic group.

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TVII–06 BIODIVERSITY OF SPIDERS IN SCRUB FORESTS OF CAUVERY DELTA, TAMILNADU

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Spiders are classified in the order Araneae under the class Arachnida in the most successful phylum Arthropoda which comprises roughly one million known species. These obligate suctorial carnivores, often forms, a large part of the predatory arthropod fauna in all ecosystems, particularly in forest ecosystem. At present more than 34000 species of spiders have been named in the world and nearly five times this number

may need their discovery (Platnick, 1989). Because of the general insect predatory activities, their presence in an ecosystem may well influence the population dynamics of other arthropods present.

Study conducted in scrub areas of Cauvery Delta, Tamil Nadu revealed presence of natural assemblage of wide diversity of spiders. They interact with other organisms of the same habitat and it has therefore been supposed, that spiders may play an important role as a stabilizing agents and / or regulators of insects population in scrub areas apart from the adjacent agro and terrestrial ecosystems. Hence, it is of great importance to make a systematic study of spider diversity present in various ecosystems particularly in the forest ecosystems of Tamil Nadu to document and characterize the spider diversity as a basis for further studies, particularly for biological control.

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TVII–07 POPULATION DYNAMICS OF SOIL ARTHROPODS UNDER DIVERSE TREES SPECIES FOR BIORECLAMATION OF ABANDONED TEA GARDEN IN ASSAM

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A multitude of fascinating relationships exists among insects and other life forms of a forest. The diversity of the forest plant species and their structural complexity provide numerous niches for insect inhabitation. Further, the litter associated with the forest serves as a unique habitat for vast variety of arthropod species. A study was carried out at research station of Rain Forest Research Institute, situated at Nahoroni, Golaghat district of Assam, from February 2001 to January 2003 to assess the impact of tree species on soil arthropods, which are important members of the forest ecosystem for the release of mineral nutrients and thus improve the productivity by decomposition process. The study dealt with the systematic analysis of forest soil arthropods and the assessment of the influence of different tree species on the population dynamics of soil arthropods. Results from this study indicated that Acarina and Collembola population was high in all the tree species surveyed. Acarina, Collembola, Hymenoptera, larvae of Coleoptera, Lepidoptera, and Diptera, centipede and millipede were major groups from soil samples known for litter decomposition. Arthropod population was high in winter season when compared to the summer. Trees such as *Gmelina arborea, Litsea nitida* have more pronounced impact on dynamics of litter arthropods followed by *Dysoxylum procerum, Alstonia scholaris, Albizzia lebbek, Ficus hispida,* and *Samanea saman*. Trees such as *Melia azedarach, Taphrosia candita, Chukrasia tubularis, Lagerstroemia speciosa, Actinodaphneae angustifolia* have least impact on dynamics of litter arthropods. Non Fabaceae tree species harboured more number of litter arthropods than the Fabaceae species.

TECHNICAL SESSION - VIII

ETHICAL, CULTURAL, SCIENTIFIC AND ECONOMIC DIMENSIONS IN FOREST BIODIVERSITY POLICY ISSUES

TVIII–01 POLICIES FOR CONSERVATION OF FOREST BIO-DIVERSITY RESOURCES IN INDIA

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Forests, - an important eco-system that provide many goods and services - occupy less than one third of the Earth's total land area. They bring ecological, environmental, social and economic sustainability and maintain life support systems essential for life on earth. Some of these life support systems of forests are: supply of timber, fuel wood, fodder, food and wide range of non-wood products; offer natural habitats for bio-diversity and respository of genetic wealth; rouse recreation and built opportunities for eco-tourism; preserve watersheds that produce and store water; control floods, act as carbon sequestration and carbon sinks; offer spiritual sustenance to an increasingly crowded world; influence the local climate conditions; regulate the global bio-geochemical cycles; prevent the soil erosion, mud slides and protect the soil fertility; provide essential habitats for many organisms etc. In spite of incredible role, forests are destructed and denuded, due to forest fire, drought, unscientific land clearing practices, expansion of agriculture, construction of roads and dams in forests, tree harvests, insects and diseases. These scenarios are echoed in the report of the World Commission on Forests (1999). It concludes that earth's forests are shrinking each year by 50 million hectares (37 million acres). Forests destruction, particularly in the tropics, threatens indigenous people, whose cultural and physical survival depends on the forests and creates "ecological crises" in forests and "ecological refugees" among the indigenous and tribal people. This ultimately leads to destruction of Indigenous Knowledge Systems (IKS) which roars the international attention for preserving and protecting the wealth of indigenous knowledge. Besides, the global community is facing environmental problems. Thus, the global knowledge workers should pay attention for conserving the natural resources and improving the status of environmental resources by involving governments (central, state and local), native tribes and stakeholders, conservation organizations, universities, corporate sectors and individuals. They have to take initiatives for solving the environmental problems and conserving the environmental resources in a holistic manner through sustainable policies and feasible strategies, viable acts and laws, appropriate economic tools and instruments, acceptable fiscal and social instruments. In this context, an attempt has been made by the authors to trace out the evaluation of forest policies, environmental policies and policies for bio-diversity conservation with special reference to India. The authors felt that there is a need for the integration of all these policies which bring ecological, environmental, social and economic sustainability in forest bio-diversity resource management. The net results of the policy mix in different arena meet the needs of the present as well as the future generations.

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TVIII–02 NTFPs FROM FOREST: STRATEGIES FOR CONSERVATION AND DEVELOPMENT

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Non Timber Forest Products (NTFPs) have been receiving increased attention for their potential to improve the income of the forest dependent communities. In United Nations Conference on Environment and Development (UNCED) 1992, too highlighted the importance of NTFPs in Sustainable Forest Management. It is estimated that about 300 million people living in and around tropical forest are dependent on NTFP for their livelihood. NTFPs form an important source of livelihood especially those who are at the bottom of economic level.

The increased rate of forest conversion has lead to decimation of these NTFPs, leading to their disappearance. Despite their socio-economic importance the lack of scientific knowledge of NTFPs, their distribution, conservation status, silviculture, collection, processing methods and marketing are some of the issues related to its development. There is immense opportunity to set up enterprises based on these resources to improve the income of the forest dependent community.

This paper analyses socio-economic and ecological factors that constrains the sustainable management of NTFPs and highlights the strategies for effective management of NTFPs on sustainable basis for improving the livelihood of the income of the forest dependent community.

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TVIII–03 DIRECT SEEDING AND REDUCED TILLAGE OPERATIONS IN MIXED CROPPING SYSTEMS OF NORTH EAST INDIA: A CASE STUDY ON THE WEST KAMENG DISTRICT OF ARUNACHAL PRADESH

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An agricultural practice in Arunachal Pradesh is quite diverse owing to the richness of ethnic diversity. Traditionally, several strategies have been adopted by different tribes to meet the day-to-day food requirements through having extensive cultivation and also village kitchen gardens. The practice of mixed cropping of agricultural crops through direct seeding has been a part of traditional practices that has continued among the Monpa tribes residing in the hills of West Kameng district (Eastern Himalaya) of Arunachal Pradesh since time immemorial. These practices have been indigenously developed to counteract soil degradation, reduce water percolation,

and prevent the outgrowth of weeds and to achieve sustainable crop production. Besides tropical and sub tropical conditions in temperate conditions as well the efficiency of an agricultural system increases with the introduction of multifunctional cover crops growing in rotation with the main commercial crops or whenever climatic conditions are too risky for planting a commercial crop. The practice of mixed cropping systems leads to a better utilization of available natural resources throughout the year, more biomass production, permanent soil protection and higher organic restitutions to the soil. Reduced tillage practices are being practiced for raising beds for rice and maize (the common crop of the region).These traditional practices have lead to environmental, economic as well as agronomic gains to the farmers in particular and to the region in general besides providing an ample scope of livestock production and sustainable development.

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TVIII–04 SOCIO ECONOMIC APPROACH ON FOREST BIO-DIVERSITY IN NILGRIS (UDHAGAMANDALAM) AND ITS CONSERVATION

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Biodiversity or Biological diversity could be described as the variety of and variability in Flora, Fauna and microbes in an ecosystem. The entire geographical area of India is classified into "Forest Cover" and "Non-Forest Cover" Forest Cover includes all lands with tree crops, which may be either open forest or domestic forest. According to Forest Survey of India, the total forest area in India is 768,437 sq.km in 2001 of which Tamil Nadu constitutes 22,871 sq.km. In terms of total recorded forest area, Tamil Nadu occupies 13th place.

Udhagamandalam is described as "Queen of Hills". It is not only a picnic spot but also a health resort. The forest cover of Ooty includes Tree crops, Fruit orchids, Agro-forestry plantations and Coffee and Tea estates. Tourist arrivals in Udhagamandalam have been exhibiting an increasing trend one year to another, besides, the monsoon rains in Ooty have gradually decreasing and as a result, scarcity of drinking water during the summer has become an acute problem. Owing to the usage of toxic and synthetic chemicals and rapid construction activities through deforestation, littering, spitting, waste generation and urbanization, the biological and ecosystem of Ooty such as air, water, fertility of the soil, grcenish atmosphere have been affected to a great extent. According to the prediction of scientists, Ooty lake will gradually disappear due to incoming rubbish after 25 years.

It is the high time to evolve and implement conservation methods. Ex-Situ and In-Situ conservation methods are absolutely required for protecting the fast depleting flora and fauna. Steps may also be taken to launch Biotechnology action plans include development of social forestry arresting grazing, conserving the available grasslands, stopping division of forestlands preventing air and water pollution, minimizing the excessive tourist pressure in Ooty, reducing exotic plantation, arresting habitat fragmentation and poaching. These measures will go a long way in protecting anl go a long way in protecting an in Udhagamandalam.

TVIII–05 ECO - DEVELOPMENT PERSPECTIVES FOR THE PALANI HILLS (KODAI HILLS, SOUTHERN WESTERN GHATS, TAMIL NADU)

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The Palani Hills are an eastern off shoot of the Western Ghats with a maximum East to West length of about 65 kms and a maximum width of about 40 kms. While the extent of the hills considerably greater. This paper for statistical accuracy of presentation, concentrates on the area of Kodaikanal Taluk - approximately 1050 sq.kms. Kodaikanal Panchayat Union, which is the development unit, is coterminous with the area of the Taluk.

A curious feature of the Palani Hills and even its highest reaches is that, unlike most of the other areas of the Western Ghats, the region is basically dependent on the North - East monsoon and not the south west monsoon.

It is evident from the data collected so far, that in the palanis, any programme of development has to begin the provision of basic needs. Some of the facets of the 'basic needs / eco - restoration' programmes are as follows:

1) As far as water supply is concerned, the problem lies, not in insufficiency of rainfall (average rainfall 1600 mm) but in lack of storage facilities.
2) Provision of basic medical facilities with a special emphasis on child health and sanitation is imperative.
3) Emphasis should be providing reasonal access.
4) Apart from the 'basic needs' programme what the palanis really requires, if agriculture is to improve, is an efficient wholesale market.
5) As far as industrialization is concerned, it is clear that the palanis must continue as a 'no industry' zone.
6) A new park representative of the flora of Palani Hills, with an orchidarium, herbal garden should be opened.
7) A yoga and meditation centre.
8) A health Spa and nature cure clinic.
9) A game sanctuary could be notified in a portion of the Palani Hills.
10) Summer training camps for athletics and other sports.
11) Nature education camps aimed at the young, with upto date audio visual facilities, museum etc.

The administration of any programme of eco - development will require a higher degree of commitment on the part of the concerned officials than what is obtaining at present. In eco - development programme would - obviously, require the coordinated action of several departments.

In these circumstances, it is felt that eco - development programme would succeed unless a separate centralised development authority for the Palanis, with the power to supervise the working of the various departments in the hills in constituted.

POSTER SESSION I

I. FLORISTIC ANALYSIS AND BIODIVERSITY

PI-01 NUMERICAL PHENETIC TAXONOMY OF CERTAIN MEMBERS IN LEGUMINOSAE

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Numerical taxonomy aims at determining the relationships between organism or taxa. Eventhough numerical taxonomy does not assume phylogenetic relationships it is obvious that close correspondence of a large number of phenotypic characteristics has something to say about genetic connections. The present study is aimed to analyse the phenetic relationships between the members of Leguminosae through numerical taxonomy. 47 different species of Leguminosae were chosen as Operational Taxonomic Unit (27 units belongs to Papillonoideae; 13 units belongs to Ceasalpinioideae and 7 units belongs to Mimosoideae). 220 characters were used as attributes for the numerical analysis to predict the phenetic relations among the members of Leguminosae. Based on the presence or absence of the characters t x n (taxon Vs character) table and t x t (taxon Vs taxon) table were prepared. Similarity and dissimilarity data matrix were derived from t x t table. The clusters obtained from the similarity data were analysed. Through this data analysis it is proposed that the taxa like *Crotolaria, Rhynchosia, Theprosia, Indigofera, Alysicarpus, Pongamia, Dolichus, Cassia, Caesalpinia, Mimosa* and *Acacia* form a separate cluster and which are comparable to the different tribes placed under subfamilies of Leguminosae. These clusters are formed on the basis of phenetic observations.

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PI-02 FLORISTIC DIVERSITY OF TIRUNELVELI PLAINS, TAMIL NADU.

S. Maria Victorial Rani and D.Vanila

The plains of the Tirunelveli District in TamilNadu, a constituent state of India have not been botanized in the past. The geographical location of the area adjacent to the legendary Agasthiamalai in the Western Ghats, the island SriLanka and partly bounded in the east by the Bay of Bengal is unique. The district receives a mean annual precipitation of 799 mm, temperature range 35 C-22.9 C, relative humidity 40% to 70%, wind velocity 2-43 km/h. Alluvial, black, red and laterite soils are predominant in

this Tirunelveli plains. The hill flora of the district in particular is already known to be rich and diverse and is also considered to be the epitome of the whole of Tamil Nadu state (Mudaliar and Sundararaj, 1954). The present work was undertaken with a view to provide an authentic inventory of the flora of the plains,including vegetation types and interesting plant groups.

The systematic exploration of the plains of Tirunelveli District for a period of three and a half years has resulted in the collection of nearly 3000 plant specimens belonging to 793 species in 416 genera spread across 102 families. The species collected include 40 species of peninsular endemics. The plant species of the study area fall under herbs, shrubs, trees and climbers. The major vegetation types of the plains are, a) Coastal extending from Uvari town to Perumanal, b) Southern tropical thorn forests bordering the coastal plains, c) Riparian along the courses of the rivers, d) Aquatic and semi-aquatic in lakes, ponds, puddles, marshy lands, e) Grasslands in the slopes of foot hills.

The interior plains which cover major part of the district are the most densely populated where most of the natural vegetation has been replaced by plantations and paddy fields. The rural economy is agriculture based and cereal production with Oryza sativa L. followed by Sorghum bicolor (L.) Moench.., Eleusine coracana (L) Gaerth.., Saccharum offcinrum L. Plantations on the plains are made of Eucalyptus globules labill, Azadirachta indica A. Juss., Psidium guajava L., Casuarina litorea L., Tectoria grandis L. f., Mangifera indica L., Cocos nucifera L., Musa paradisiacal L., Anacardium occidentale L., Citrus aurantium L., etc. As the topography of the plains got defaced over the hundreds of years, many intrusive elements particularly from tropical America and Australia have erupted into the wastelands and farmlands. The most hazardous of these is Prosopis chilensis (Molina) Stuntz, which has colonized most of the unused lands and waterways to the detriment of the native flora.

Investigations of the flora enabled categorization of certain species of plants into the following groups based on their distribution, associations and availability.

New Species: Euphorbia manickamii Vanila et al.

Threatened species: Erogrostis rottleri Stapf. is rediscovered in Vallioor after 100 years.
Endangered species: Maerva apetela (Roth) Jacobs, Hybanthus travancoricus (Bedd.) Melch. and Didymocarpus gambeanus Fischer.

Flagship species: 1)Aerva lanata (L.) Juss. 2) Glinus lotoides L. 3) Ocimum ammericanum L. 4) Euphorbia antiquorum L. and 5) Lantana camera L. If these flagship species are destroyed, it is likely that the associated plants will also disappear from the community.

The study area is also an abode of a variety of timber species such as Tectona grandis L. f., Azadiractata indica A. Juss. And Thespesia populnea (L.) Soland. ex Correa with high commercial value. Due to the illegal cutting and felling of large trees, the plains are getting barren and some endemic species are under threat. Since the species support other plants and animal forms and contribute to

biodiversity richness, attention of the public, private and self-help groups is called for the preservation as well as sustainable utilization of the arborescent elements in particular.

At present a wide range of physical (fire, flood, storm) and biological (grazing, disease) factors alter the biodiversity by disturbing the component species or by promoting the entry of exotic species. The villagers rear a large number of goats and cows, which graze upon the open lands and flora of the fences. As these animals are linked to the livelihood of the rural folks, the District administrative may enter into dialogue with the local communities and through their participation grazing can be reduced to permit the growth and productivity of the species in the plains.

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PI-03 MANGROVE PLANT DIVERSITY AT CORINGA WILDLIFE SANCTUARY, ANDHRA PRADESH

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Mangrove plants are an assemblage of flowering plants growing in the inter-tidal region of tropical and subtropical regions. India is blessed with unique mangrove ecosystems. The mangrove forests contribute to about 1% of the total forest area of Andhra Pradesh. The total mangrove species at Coringa Wildlife Sanctuary in Godavari delta are 39 species, which belong to 29 genera in 23 families; The species include *Rhizophora mucronata, R. apiculata, Bruguiera gymnorrhiza, B. cylindrica, B. parviflora, Ceriops decandra, C. tagal, Kandelia candel* (Rhizophoraceae), *Avicennia alba, A. marina, A. officinalis* (Avicenniaceae), *Sonneratia apetala* (Sonneratiaceae), *Acanthus ilicifolius* (Acanthaceae), *Hibiscus tiliaceus* (Malvaceae)**,** *Excoecaria agallocha* (Euphorbiaceae), *Xylocarpus mekongesis, X. moluccensis* (Meliaceae), *Aegiceras corniculatum* (Myrsinaceae), *Lumnitzera racemosa* (Combretaceae) and *Scyphiphora hydrophyllacea* (Rubiaceae), *Derris trifoliata, D. pentafolia, Dalbergia spinosa* (Fabaceae), Caesalpinia bonduc, *Cynometra ramiflora* (Caesalpiniaceae), *Ipomoea tuba* (Convolvulaceae), *Clerodendrum inerme* (Verbenaceae), *Barringtonia racemosa* (Lecythidaceae), *Suaeda nudiflora, S. maritima, S. monoica, Salicornia brachiata* (Chenopodiaceae), *Sesuvium portulacastrum* (Aizoaceae), *Cerbera manghas* (Apocynaceae), *Sarcolobus globulus, S. carinatus* (Asclepiadaceae) *Acrostichium aureum* (Pteridaceae), *Porteresia coarctata* and *Myriostachya wightiana* (Poaceae). These plant species collectively make up mangrove vegetation at Coringa and have great importance to people who live in the vicinity of their formations. They are important for fuel wood, tannins, alkaloids, saponins, medicines, food for animals, breeding grounds for aquatic organisms, etc. Fuel wood collection, tree felling, fishing, conversion mudflats to aqua-ponds, etc. have caused degradation of the healthy functioning of the mangrove systems here.

Unless restoration and sound management practices are implemented, the present populations would further decline and pose a great threat to coastal areas and life as well.

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PI-04 ALTITUDE ASSOCIATED CHANGES IN PLANT DIVERSITY AND ITS EFFECT ON BIOMASS PRODUCTION IN SEMI-ARID FOREST

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Forest diversity is the main parameter used to access the performance of forest and it is associated with some other parameters like biomass, altitude and rainfall etc. This association is the subject of interest for foresters as well as ecologists. This study was conducted in Jessore Sloth Bear Wild Life Sanctuary, situated in Banaskhanta District of Gujarat and forest of this area is classified as Southern Dry mixed deciduous forest and Northern Tropical thorn forest. More than two third area of the sanctuary is covered by South- western end of Araveli hill ranges having altitude more than 1100msl. In Araveli hills this place is the second best after Mount-abu with its flora and fauna biodiversity richness point of view. Objectives of this study were to access the biodiversity status of woody species, and their contribution to forest biomass in different elevation zones.

To access the plant diversity and biomass of forest area at different altitude levels, whole area of the Sanctuary was divided in three elevation zones *i.*e. blow 300msl, 300msl. to 600msl. and above 600msl. Approachability of these zones and sampling plot selection was done by using topo-sheet of the area and geographical information system (GIS). Area under different forest types was calculated by digitization of forest vegetation map. Species richness, abundance, density, diameter at brest height (DBH), dominance, frequency, importance value index (ivi), canopy cover, diversity indices and association index were calculated from temporary sample plots to access the biodiversity status of the forest in different altitude zones.

Characteristic of most arid ecosystems is the relationship between vegetation dynamics and environmental variation in climate, soils or other disturbance is prominently noticeable. It was observed in sample plots that degraded forest contribute about 14.53 t ha^{-1} in the lower elevation zone (blow 300 msl.) and total area covered by this type of forest is 3035.31 ha. In this area some open and dens forest patches are confined along water channel only. Some dominant species like *Prosopis juliflora, Lannea coromandelica, Wrightria tinctoria, Anogeissus pendula, Zizyphus* Spp. contribute more than 70% in the biomass of degraded forest while rest is contributed by *Butea monosperma, Acacia nilotica, A. catechu, Pongamia pinnata.* In the sample plots, seedling percentage is very less in lower zone while it is relatively high in middle and upper zones. This represents very high grazing pressure in plane area. With regeneration point of view canopy cover of this region is range from 15% to 30%. In middle zone (300msl. to 600msl.) *Butea monosperma, Aegal marmelos, Diospyros melanoxylon, Boswellia serrata, Lannea coromandelica* are dominant woody species having high importance value index (ivi) and other species like

Wrightria tinctoria, Anogeissus pendula, Anogeissus latifolia and *H. integrefolia* etc. have very less importance value index. Half area of middle zone is covered by open forest, 27% by degraded forest and rest is dense forest. Average biomass density of open forest is 50.57 t ha^{-1} while it is 100.23 t ha^{-1} for dens forest. In upper zone 50% area is under open forest. Here dominant species includes *Dendrocalamus* Spp., *D. melanoxylon, M. tomentosa, Terminalia tomentosa, Wrightia tinctoria, A. marmelos.* And *Albizzia lebbeck, B. monosperma, A. pendula* are less abundant in the upper elevation. Upper zone have less forest cover due to less soil depth, excessive water run off and high wind velocity. Association index of sample plots shows that lower and middle zone are more similar than middle and upper. Higher plant diversity among woody plants was noticed in middle (300msl to 600msl) altitude zone while lower zone (blow 300msl.) and upper zone (above 600msl.) were on second and third position respectively. Highest biomass of the forest was found in the middle zone due to high abundant and frequency of the species.

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PI-05 DETERMING THE GENETIC VARIABILITY IN DIOSCOREA ALATA L. IN TIRUNELVELI HILLS IN TAMILNADU

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Dioscorea alata commonly known as "Winged Yam" belonging to the family Dioscoreaceae is one of the most important medicinal herbs used in Indian medicine for asthma, rheumatism, and food for cattles. The distribution of genetic variation as revealed by RAPD markers was examined in population of this species from Tirunelveli district. It was observed that this medicinal plant possesses a considerable degree of genetic variation. Random Amplified Polymorphic DNA (RAPD) fingerprints were analyzed by polymerase chain reaction (PCR) of genomic DNA using random primers. The RAPD fragments were scored for presence/absence, to calculate Jaccard's similarity index. Clustering based on similarity index was done following unweighted pair group with arithmetic mean method and a dendrogram was constructed and analyzed. The five primers used to analyze genetic variation in this plant produced 35 polymorphic bands (loci). The same type of bands occurred at different frequencies in all populations. The genetic distance between the population ranged from 0.2157 to 07623 and the genetic identity ranged from 0.3231 and 0.6275. The overall observed and effective number of alleles is about 2 and 1.58 respectively. The overall genetic diversity according to Nei's index is 0.4022. Considerable amount of genetic variability is observed. Reasons for such variability is discussed.

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PI-06 GRASSES OF CHITRADURGA - A CASE STUDY WITH REFERENCE TO JOGIMATTI SCRUB FOREST DISTRICT, CHITRADURGA, KARNATAKA STATE

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"Grass is a king" it rules and governs the world, belongs to the family Poaceae, which is one of the second largest on monocotyledons and worldwide in distribution. It consists of 620 genera, 10,000 species which yield paper, pulp, medicine, fodder, essential or aromatic oil etc. The grasses show a great diversity in their habitat and play an important role in soil conservation.

Chitradurga forest division occupies almost a central position in the eastern plains of Karnataka and its boundaries are co-terminus with that of Chitradurga revenue district. The forest area of the district is 440 Km^2 (5.27% of state) of which very dense forest is zero, moderately dense forest is 49 Km^2, open forest is 396 Km^2.

Jogimatti scrub forest is situated about 13 Kms away from the Chitradurga town. It includes both dry mixed deciduous and dry deciduous scrub patches which harbors many valuable species of plants and animals.

The present study has been taken up to find out different types of grass species available in "Jogimatti scrub forest", about 35 different varieties of grasses and their uses like fodder, medicinal, economic, poisonous effects are revealed in the present report.

An attempt has been made to document and identify the different varieties of grasses which attracts great importance with respect to the germplasm of grasses of Chitradurga district.

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PI-07 GLOBAL DIVERSITY OF THE MINT GENUS *LEUCAS* R.BR (LAMIACEAE: LAMIOIDEAE) WITH SPECIAL REFERENCE TO SOUTH INDIAN SPECIES

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The genus *Leucas* R.Br. consists of about 103 species distributed mainly in the tropics of Africa, Asia and Arabia. This pantropical genus has its highest diversity in the African continent, which is considered as the center of origin of many Lamiacean genera. Second highest diversity is found in Asia and the

species found in this region are entirely different from African species. Arabian diversity consists of 13 species, which are identic with African species or near relatives of them. It has already suggested that *Leucas* originated in northeast tropical Africa and to have migrated from this area over Arabia to Indian subcontinent.

The pattern of species diversity shows that African diversity is highest in the regions of east Africa where almost 13-15 species are reported. About 80% of Asian species (33 species) are found in South India and the diversity exhibited by the southern Western ghat region is higher than east African diversity. Of the 24 species found in this region, 10 are endemic here. This is followed by Eastern ghat where 20 species are found.

Eventhough diversity of *Leucas* species are more in African region than Asian region, the species richness as a measure of diversity is more in southern Western ghat region of South India than Africa. Moreover, the diversity of endemic species, which are morphologically very distinct from African, also lead to propose that South India represent the secondary center of origin of *Leucas*. Cladistic analysis revealed the monophyletic origin of Asian species and it is attributed that hybridization might be the reason for high diversity in Asia. Phenetic analysis of the relationships and pattern of diversity is discussed.

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PI-08 LIMNOLOGICAL ROLE OF AQUATIC PLANTS IN GODHULI POND, ALNAVAR TALUK, UTTARA KANNADA

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The aquatic macrophytes play a significant role in regulating the trophic status of the pond. Aquatic weeds in India are one of the crucial problems of Pisciculturists. These weeds are widely growing in unmanaged ponds and imbalance the pond ecosystem. Seasonal variations of aquatic plants were considered for the present study in Godholi pond. Aquatic plants collected from the pond were identified and categorized into five groups, submerged, suspended, free floating, floating-leafed & anchored and emergent. *Nymphaea* is more dominant than *Nymphoides* in the pond.

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PI-09 PLANT DIVERSITY STATUS OF CONSTRUCTED AND SEWAGE POLLUTED POND, DHARWAD, KARNATAKA

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Phytoplankton and macrophytes are the main primary producers of the aquatic ecosystems. Phytoplankton plays a key role in the freshwater ecosystem, because they function as a primary producer in the food chain of the water body and maintaining proper equilibrium between biotic and abiotic components in the aquatic ecosystem. The source of water pollution mainly consists of sewage, industrial waste, detergents, and automobiles wastes. These pollutants adversely affect the structure and function of components, environmental quality and aesthetic value of the freshwater ecosystem. Field investigations were undertaken to study the plant diversity status of constructed pond and sewage polluted pond. A total of thirteen species of aquatic macrophytes were recorded from the constructed pond which includes two fern sps. Six monocots belonging to five families and five dicots belonging to five families. Phytoplankton enumeration revealed a total of twenty one species of which six species belonging to Cyanophyceae, seven species to Bacillariophyceae, five to Chlorophyceae and three to Euglenophyceae Cyanophyceae and Bacillariophyceae were dominant when compared to other families while, sewage polluted pond reveals that there are twelve species of aquatic macrophytes of which one fern species and six monocots representing six families and two dicots representing two different families. Nineteen species of phytoplankton were enumerated which includes to five species of Cyanohyceae, four species of Bacillariophyce and six species of Englenophyceae. *Microcystis* and *Engleunoids* are found to be dominant which indicate sewage pollution of natural pond. Results show plant diversity is high in constructed pond.

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PI-10 ANALYSIS OF PLANT DIVERSITY IN KULDIHA WILDLIFE SANCTUARY OF BALASORE DISTRICT, ORISSA

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Orissa is well known for its diversified flora due to prevailing of sub-tropical climate. More than 31% of the total geographic area is under forest cover. In the present study, plant species diversity of Kuldiha Wildlife Sanctuary (KWS) was analysed. The sanctuary area spreads over 272.75

sq km in the Nilgiri hill ranges of the Baripada forest division. It has a luxuriant forest cover, which creates habitats for many endangered and threatened animal species. Sample plots were randomly laid down throughout the sanctuary area. All the forest types were sampled. The study reveals that Sal mixed moist deciduous forest is dominant in this region. On the basis of important value index (IVI), *Shorea robusta* and *Terminalia alata* were observed to be the dominant tree species. From the phytosociological data analysis, 95 tree species are found followed by 24 shrubs, 81 herbs and 32 climbers. Index of diversity (H) is higher in trees (5.4) followed by herbs (6.3), shrubs (4.9) and climbers (4.5). *Elephantopus scaber* and *Vernonia cinera* were the top IVI species among herbs. The results are discussed along with the management implications.

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PI-11 COMPARATIVE ANALYSIS OF TREE SPECIES COMPOSITION, DIVERSITY AND DOMIONANCE ALONG A DISTURBANCE GRADIENT IN TROPICAL DRY DECIDUOUS FORESTS OF BHADRA WILDLIFE SANCTUARY, KARNATAKA

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Three dry deciduous forests of Bhadra Wild life Sanctuary, Karnataka are categorized as Naturally Disturbed Forest (NDF), Disturbed Forest (DF) and Partially Disturbed Forest (PDF) across a disturbance gradient. Each forest was sampled using ten transects of 50x4m quadrats making an area of 0.2ha, wherein DBH and species identity of all individuals >/= 10 cm were enumerated. Relative density, Relative frequency, Relative dominance and Important Value Index for all the tree species were calculated. The NDF recorded the higher plant diversity of 307 trees/0.2 ha followed by DF (274 trees/0.2ha) and PDF (192 trees/0.2 ha). But DF has the highest basal area value of 9.08 m^2/0.2 ha over NDF (8.14 m^2 /0.2 ha) and PDF (6.87 m^2 /0.2 ha). The NDF also dominated the diversity components. The value of 2.62 (Shannon Diversity Index), 5.87 (Margalef Species Richness Index) and 0.759 (Pielou's Equitability Index) is comparatively higher over 2.29, 5.41, 0.68 of DF and 2.50, 5.23 and 0.751 of PDF respectively. The Jacard Similarity Values of 0.465, 0.47, 0.47 and the Sorenson Similarity Values of 0.63, 0.64, and 0.64 along with the Whittaker's â diversity value of 0.406 indicated that the three forests are almost similar in their species composition. Overall, the study revealed that the diversity and dominance of tree species increased over the increasing disturbance.

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PI-12 VEGETATIVE PHENOLOGY OF TROPICAL DRY DECIDUOUS FOREST OF BHADRA WILD LIFE SANCTUARY, KARNATAKA

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Dry deciduous forests may be the most threatened and least understood tropical forests. Yet relatively little is known about their ecology, sustainable management of natural tropical forest is not possible without a better holistic understanding of their ecological functioning. Seasonality of tropical trees helps us to understand the influence of phonological events on feeding, movement patterns, sociality of birds and mammals. Vegetative phenology of 35 tree species of tropical dry deciduous forest of Bhadra Wild life Sanctuary, Karnataka was monitored from June 2004 to January 2006, through a monthly visit. There exists a considerable diversity in initiation, expansion, maturation and abscission of leaf. Leaf falling 30% starts in the post-monsoon at low temperature to beginning of driest period (Nov- Feb), simultaneously leaf initiation and expansion begins with the rise in temperature and peak in the driest pre-monsoon period over 60% (Feb-Apr), could be to take full advantage of the rainy season for reproductive phenology and to escape from herbivore. Peak flowering coincided with peak flushing in *Bombax malabarica, Butea monosperma* and *Spondias pinnata*. Maturation to abscission of leaf will be the longest phase (May-Oct) in their life cycle. Extent of herbivore was recorded highest in *Spondias pinnata, Zizyphus xylopyrus, Adina cordifolia* and *Tectona grandis*. Leaf spots were recorde in *Adina cordifolia* (brown spot) and *Lagerstroemia lanceolata* (black spot).

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PI-13 SCREENING OF THE CYANOGENIC PLANTS OF GOLA GOKARAN NATH TEHSIL OF LAKHIMPUR KHERI DISTRICT (U.P.)

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Gola Gokarannath tehsil is situated between 27º62' & 27º99'N latitude &80º25' & 80º65' E logitude. The tehsil is an open plain with the area of 1,06,053 hectare in which 4665 hectare is the dense Sal forest & remaining area is under high state of cutivation. It is situated at 156.5 m msl. The climate is monsoonic type & soil is alluvium. The tehsil is vegetationally very rich. During the floristic exploration of the tehsil some cyanogenic plants were reported there. These cyanogenic plants were subjected to test for hydrogen cyanide (HCN) & 13 plants were confirmed to contain HCN in their different parts. HCN in cyanogenic plant is formed by hydrolysis of some glycosides. These cyanogenic plants are *Abrus*

precatorius Linn. (seeds); *Acalypha indica* Linn. (leaves); *Bambusa bambos* Druce. (green leaves); *Crataegus oxyacantha* Linn.(Young shoots); *Ctenolepis garcini* Linn. (leaves); *Linum usitatissimum* Linn.(Seeds); *Lolium temulentum* Linn.(Grains); *Melothria maderaspatana* Linn.(seeds); *Poinciana pulcherrima* Linn. (fresh leaves); *Prunus persica* Linn. (Seeds); *Sorghum vulgare* Linn. (leaves); *Themeda triandra* Forsk(Whole plant); *Vicia hirsuta* koch. (seeds); *Vicia sativa* Linn. (seeds).

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PI-14 CENSUS OF THE PLANTS IN BHARATHIDASAN UNIVERSITY CAMPUS, TIRUCHIRAPPALLI. TAMIL NADU

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India is one of the 12 mega bio-diversity countries of the world and has two hotspots (North East Himalayas and Western Ghats) out of 25. India is not only a biodiversity-rich country but also one among the 8 centres of origin of domesticated crop species. Due to an extensive and unabated destruction of forests, mankind is loosing many valuable plants even before we come to know them. Hence, documentation of plant species in any area is urgent need. Bharathidasan University located in the southern part of the Tiruchirappalli city on the Tiruchirappalli – Rameswaram national high way is a semi arid region, its annual rain fall is 830 mm and the minimum and maximum temperature is 25 and 40°C respectively. The total area of the Bharathidasan University campus is above 1200 acres. The exploration was made in different seasons and the plants were collected, classified, identified and then documented. We have identified 380 species of belonging to 280 genera under 80 families. The 380 species include introduced ones, ornamental plants and wild taxa. Among the 380 species, there are three gymnosperms (all introduced), five pteridophytes (3 wild and 2 introduced; among the 3 wild species 2 are endangered), and 5 species of Orchidaceae.

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PI-15 EFFECT OF HIGH VOLTAGE (HIGH TENSION) POWER TRANSMISSION LINES ON HERBACEOUS SPECIES COMPOSITION AND BIODIVERSTY IN AYYANAR KOIL HILLS OF WESTERN GHATS, TAMIL NADU

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Biodiversity is an inherent quality of all the living organisms. It is essential for attaining sustainable gains in productivity per units of land, water, energy and time. To a greater extent it depends on the people of the region, their cultural, social and food habitats as well as agricultural priorities (Bilgrami,

1995). Expanding human population has caused increased resource exploitation and the alteration of land use pattern. The loss of biodiversity is mainly due its inherent ecocycle and a number of endogenous and exogenous processes, which have accelerated the erosion of valuable germplasm stock.

Development activities like construction of roads, bridges, railway lines and erection of high power transmission lines etc also destroyed a number of plant habitats. Therefore the conservation of plants is vital to the continued existence of life. Each species has different habitat requirements, performs different ecological functions in different ecosystem and has different uses of potential uses for humankind. . It is therefore important to design of appropriate conservation techniques and management for these plant species.

In our country most of the high voltage power transmissions lines passes through the agricultural and forestlands. The flow of electricity along a conductor/wire establishing an electromagnetic field around it influences the living organisms like plants and animals by the way of electromagnetic induction (Markus Zahn, 1999). The voltage level of high voltage transmission line is 400 KV, 230 KV and 110 KV (Alston, 1968). This electromagnetic field affects the growth of plants and human beings. However no reports are available on the effects of high voltage power transmission line on forest plant species and its composition

The Ayyanar koil Hills situated at eastern slopes of the Western Ghats of south India. This hill lies in the Virudhunagar district of Tamil Nadu and forms a part in the Western Ghats. The study area is located at a distance of 12 Km from Rajapalayam. The altitude varies from100m to 1750m above mean sea level based on the altitudes. The floras of this region are classified into west coast tropical evergreen forest, west coast semi-evergreen forests any teak forests, southern mixed deciduous forests and dry grass lands. The average annual rainfall is of 800mm in the study area Phytosociological studies were done under Kaluthai Kadavu tower and Neeravi-tower a high voltage transmission lines of 110 KV and the area which is nearly 100m away from the high voltage transmission line in the forest area is served as control.

A total 35 herbaceous plant species were recorded from the two study areas. The number of species was greater in the high voltage transmission line site (27) compared to the control site (16). Similarly, greater number of species was recorded in high voltage transmission line sites compared to that of control site. Density, frequency, abundance and Importance value index (IVI) were estimated in each study area by using 20 randomly planned quadrats, (1 m x 1 m) for herbaceous community. The results of the present study are discussed in detail.

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PII-01 IMPORTANT FACTORS INFLUENCING THE DISTRIBUTION OF MEDICINAL FLORA AROUND BHUBANESWAR CITY

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Due to urbanization, industrialization and intensive agricultural practices plant diversity is narrowing down day by day. A study was conducted in a radius of 10 Kms around Bhubaneswar, the new capital city of Orissa to assess the erosion of genetic diversity of some medicinal plant. The city is located on the eastern coast of India, situated between 21° 15' North latitude 85° 15' East longitude and at an altitude of 45 meters above mean sea level and the average temperatures range between 15°C in winter to a maximum of 40°C to 45°C in summer. The impact of urbanization in the distribution of medicinal plants was studied basing upon the distribution of medicinal plant and their normal behaviour in ancient Bhubaneswar city, that was characterized by undulated hilly land shape covered with sparse vegetation and thin forest. Ten medicinal plants were considered for accessing the impact of mordenisation and industialisation on their distribution. The urbanization reduced the population of medicinal plants ***Strychnos potatorum, Premna obtusifolia, Toddalia asiatica, Andrographis paniculata*** and ***Evolvulus alsinoides***. The population of the medicinal flora such as ***Strychnos nux-vomica, Alangium salvifolium*** *and* ***Ocimum basilicum*** were moderately affected where as the species like ***Cassia occidentalis, Sida cordifolia*** were least affected. Factors influencing the distribution of medicinal flora were also investigated and it was found that seed bearing capacity and their germination, vegetative regeneration and reproductive performance, economic value of the plant and its product and tolerance to environmental changes were the factors influencing the population and distribution of the medicinal flora. Better distribution of ***Alangium salvifolium*** was due to its self-seeding capacity, better reproductive performance/ development and adaptability to sustain the environmental stress. Extinction of medicinal plant ***Toddalia asiatica*** within 4 Km radius and very poor distribution after 4 Km radius of Bhubaneswar city was due to its poor regeneration capacity and self seeding, susceptible to environmental changes and poor acceptability by the people for its thorny appendages in all parts of the plant. Another medicinal plant ***Andrographis paniculata*** was extinct within 4 Km because of its continuous removal as an annual weed and poor vegetative and reproductive development, though it was acclimatized to the changing environment**.**

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PII-02 REASONS FOR THE ENDEMISM OF *POECILONEURON PAUCIFLORUM* BEDD. (CLUSIACEAE) – A RARE AND ENDEMIC SPECIES

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The Western Ghats have been considered as one of the biodiversity hot spots in India, rich with various flora and fauna of which a few are included as rare, endangered and threatened (RET) indigenous medicinal species. Due to high endemism, habitat destruction and over exploitation by man, many of them are now facing extinction. In order to cope with the needs of the people, these highly valuable species need to be properly studied with a view to understanding their population structure, distribution and their regeneration prospects in a bid to safeguard and conserve them.

Poeciloneuron pauciflorum Bedd. is a rare and endemic tree species of the Southern Western Ghats of Tamil Nadu and Kerala, India. Due to the high degree of endemism, the distribution of this species is restricted to the forest region of Inchikuzhi and Kannikatty of Tirunelveli hills (Agasthiamalai) of Tamil Nadu and Travancore region (Kerala). Naturally this species reproduces by seeds only with very low regeneration capacity. Being an endemic and rare plant, this species is of great botanical interest. In the present study, a thorough exploration of this species through periodical surveys revealed the reasons for the endemism in the natural field, which has been reported in this paper.

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PII-03 FUELWOOD EXTRACTION AND THEIR IMPACT ON SPECIES COMPOSITION FROM KALAKAD-MUNDANTHURAI TIGER RESERVE, WESTERN GHATS, TAMIL NADU

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Fuel wood is the basic need for the rural people. The present investigation was made to determine the impact of land use pattern on fuel wood collection a protected forest in Kalakad-Mundanthurai Tiger Reserve. The survey was made on wet and dry agricultural landscapes in six foothill villages. The study estimated percapita consumption of forest fuel wood based on direst observation at an average of 0.37/ kg/day for the six selected villages. Fuel wood consumption analysis illustrates a variation in patterns. Average consumption ranges from 1.15kg/day/person in wet land to 1.03/kg/day/person in dry land and

fuel wood requirement ranges from 2105.36 tones/year for forest fuel wood and 1473.62 tones/year in the case of fuel wood from outside the forest. A total of 31 plant species are used as fuel wood as fuel wood in the study area. The villagers harvested 26 plant species from forest and 5 species from wasteland. Most commonly collected species are *Erithroxylon monogynum, Tectona grandis. Ficus comosa, Bauhinia racemosa, Flueggea virosa, Commiphora caudata, Spatholobus roxburghii, Hardwickia binata* and *Hugonia mystax* are regularly collected from forest, *Prosopis juliflora* is the major fuel wood species collected from outside forest. The study also revealed that fuel wood utilization was heavy in the wet land than the dry land. Hence it is concluded that the collection of fuel wood from the forest affects habitat loss and species composition in the forest.

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PII-04 STUDIES ON THE IMPACTS OF BIODIVERSITY BARRIERS AND IMPROVEMENT ON LIVELIHOODS OF TRIBAL POPULATION OF KODAIKANAL

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This paper aims to study the impacts of biodiversity barriers and the improvement on the livelihoods of tribal population of Kodaikanal.

India has a uniquely rich diversity of plant and animal life, which constitute in no small measure to the human economy. Expanding human population resulted in the expanding needs of man. With the specific progress and technological development men started utilizing natural resources at a much larger scale. The other external destructive and injurious agencies against forests are wind, frost, snow, fire, weeds, insects and fungi. Other damaging agents could be divided into sections according to the nature of agency, which produces the damage. They are damage caused by mean, animals, plants adverse climatic influences, other inanimate agencies, forest fire, encroachment, forest offences, poaching, irregularity in utilizing forest produce, abuse of forest rights, human life, recreation and scenic values and other property. Other types of threats against biodiversity could be deforestation, desertification, urbanization, river valley projects, mining, industrialization, genetic diversity and endemic species of India like birds, reptiles and amphibians.

Only when we take preventive and remedial measures and conservation of biodiversity is properly adhered to man can enjoy the utilitarian benefits of major forest produce. Minor forest produce and other manufacturing products of the forest. Conservation and protection strategies are currently in vogue, or new methods and technologies being integrated mainly keep in view the holistic approach of biodiversity conservation an attempt at the continuance, survival and perpetuation of reservoir of variation, for discovering new genes required for plant breeding and crop improvement.

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PII-05 SOME AUTECOLOGICAL CONSIDERATIONS ON THREE RESTRICTED RANGE PLANTS OF PAMBAR SHOLA, KODAIKANAL

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Western Ghats is a region well known for its rich bio-diversity. There is an increasing threat to this bio-diversity due to several factors, both natural and man made. It is time to assess the degree of this threat using adequate methods so that effective conservation strategies can be adopted.

Therefore a study has been undertaken to record the present status of 3 restricted range species.1.Psydrax ficiformis 2.Plectranthus bourneae & 3.Sonerilia pulnensis. During the course of this study, plant distribution, the phytosociology and abiotic factors such as the quality of the available water and nutrient value of soil were determined. Data on regeneration and the types of threats to these plants were collected and the prioritization score was computed. Based on these management implication are suggested for the conservation of these restricted range species.

All the 3 species require conservation measures. But Psydrax ficiformis demands more attention comparatively since this plant is the top scorer among the 3 plants in the prioritation list.

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PII-06 DETERIORATION OF MANGROVE FORESTS ALONG THE COAST OF THOOTHUKUDI, TAMIL NADU.

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Mangrove/salt marsh forests occupy the interface between land and sea, where they are exposed to a condition of high salinity, extreme tides and currents, strong winds, high temperature and muddy anaerobic soils. Mangroves create unique, ecological environments that are rich in assemblage of epibenthic, infaunal and meiofaunal invertebrates, phytoplankton, zooplanktons, fish and juveniles of prawn. The study area is located in a relatively open coast marked by Korampallam creek and extends from 8° 44' 59" to 8° 47' 16" N and 78° 09' 45" to 78° 09' 36" E. It is bounded to all sides by major industries such as Southern Petrochemical Industries Corporation Pvt. Ltd., Tuticorin Thermal Power Plant, Sterlite copper smelter, Spinning mills, etc. Besides, the mangrove strands forms a major dumping ground for municipal wastes and sewage disposal. The present work was undertaken with a view to identify the factor that cause decline in the mangrove diversity, along with the record of the accumulation pattern of heavy metals and its impact on mangrove diversity.

Systematic exploration of the mangrove sediment, water and plant parts for a period of one year (pre monsoon, monsoon and post monsoon) revealed that heavy metals such as Fe, Cu, Mn, Zn, Pb, Cd, Cr, Ni, Co, Hg, As, Mo, and Sr are concentrated more in sediments than water and plant parts in all the seasons. However the density of mangrove species *Avicennia marina, Suadea monoica, Arthrocnemum sp, Salicornia brachiata, Atriplex sp* and *Sesuvium portulacastrum* are greatly decreased when compared to the data obtained two decades ago. The heavy metal contaminants transported by the river and wind to the coastal estuary get settled in the muddy sediments. The variable concentration of these heavy metals in sediments, water and plant parts is attributed to the differential absorption of plant species, preferential accumulation in plant parts and tidal influences, soil particle size, grain size and un stabilized environment. Pearl fishing once a pride of Thoothukudi is vanishing fast.

Salt tolerant mangrove, Avicennia marina along the coastal environment is meeting a natural death. Suadea monoica is a salt tolerant and stress tolerant species now found dominant over other species in this area. This is due to land conversion for salt pans near the mangrove forest rather than heavy metal contamination. More over the inflow of water from various sources are obstructed by dumping waste leading to high salinity, causing mangrove deterioration. Thus, mangroves of Thoothukudi today face a lot of threats and continue to disappear due to conversion, over exploitation, heavy metal pollution, salt pans, mines, ports, harbor and industrial activities. An exhaust awareness campaign involving different stake holders such as coastal villagers, fishermen, students, general public, industrialists, researchers and administrators is required for mangrove forest conservation and protection. Large track of degraded areas should be regenerated with mangrove plants to enrich the biodiversity, protection from the effect of tidal bore and cyclone and also for the production of mangrove resources for sustainable utilization of fishery.

PII-07 THE INFLUENCE OF CLIMATE ON GENETIC DIVERSITY OF *PHASEOLUS SPECIES IN* KODAIKANAL HILLS

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Beans are mainly grown to meet out the protein demands of mankind.It is also said to be used for acne, bladder, burns, cardiac, carminative, depurative, diabetes, diarrhea, diuretic, dysentery, eczema, emolient, hiccups, itch, rheumatism, sciatica, and tenesmus. Beans tolerate most environmental conditions in tropical and temperate zones. A study was conducted to analyse the influence of climatic factors (temperature and precipitation) on the genetic diversity and the distribution of various phaseolus species in Kodaikanal Hills, Tamilnadu.

Of the genus ***Phaseolus sensu stricto***, which includes 55 species, five have been domesticated.. The kidney bean **(*P. vulgaris* L.)** had gained wider acceptance and was selected more intensively. It is

the only bean grown with a wide range of altitude (50-3000m) In addition to the kidney bean, four other species have been domesticated and have been maintained for thousands of years. ***Phaseolus coccineus*** grows even at higher altitudes(1400-2800m) since the fleshy root produces a second growth after light frosts. ***P. coccineus*** tolerates higher precipitations (upto2600mm) than other species of ***Phaseolus*** provided that the soil has good drainage. It grows at cooler temperatures (12úC) than other cultivated species and is generally heliophytic although it tolerates mists. In its wild form, this species displays a great phenotypical variation in its current state of evolution. in contrast with the other wild species of the genus. It produces 400 to 1000 kg per hectare in the shrubby forms while, for climbing varieties, the yield can be much higher. Unlike the case of other cultivated species of the genus, ***P. acutifolius*** was first described in its wild form. Although the cultivated and wild materials do not have a definite habitat, a desert environment is necessary. The two wild forms represent the major source of variation for future improvement of the species. Yields are estimated to be 200 to 900 kg per hectare, with wide variations depending on sowing density and rainfall. About 1000 to 2000 kg per hectare is obtained with fertilizer, with harvests of up to 4 tonnes per hectare. ***Phaseolus lunatus*** *is* a pluriannual species (except for a few modern cultivars) with epigeal germination and fibrous roots Its ancestral forms come from low or medium-altitude tropical deciduous forests. The two wild forms display marked differences but do not justify differentiated taxonomic treatment because of the considerable introgression among their genetic stocks**.** ***P. lunatus*** is a generally hardy species which prefers dry climates and deep soils (pH 6 to 7.2) with good drainage. In the shrubby forms, seed yields of 2000 kg per hectare have been recorded and, in climbing varieties, more than 3000 kg per hectare. The taxon ***Phaseolus polyanthus*** was recently acknowledged as a result of identification of its ancestral forms. The ecological conditions under which this species grows may not have been favourable for its preservation. It has frequently been cultivated together with maize, gourds and two species of bean (***P. coccineus*** **and** ***P. vulgaris***) with a humid climate and at an intermediate altitude**.** ***P. polyanthus*** is distributed in intermediate altitudes (800 to 2600 m) in cool, damp climates and it has a long flowering period (two to five months) and can have two flowering and fruit-bearing periods per year if the rainy season is heavy. It prefers deep, organic, damp and well-drained soils with pH 6.2 to 6.5 and it tolerates a degree of shade. This species is considered to be the least evolved of the cultivated ***Phaseolus*** species, hence it should have a greater potential for future development. There is little phenotypic variation (only the indeterminate climbing growth habit), including in the seeds. It is evident that ***P. coccineus, P. polyanthus*** **and** ***P. vulgaris*** are genetically close as a result of natural introgression among the species. Continued access to genetic resources of Phaseolus bean is a need based one and its conservation in the agricultural biodiversity is an essential to fight for food sovereignty. Consequently, the germplasm collected of those species.

During the last 60 years and the information relating to them, are possibly scarce in relation to what must have existed before the conquest. Unfavorable environmental conditions can produce a stress on plants resulting in lower yields. In such cases the environment can be artificially modified, such as in greenhouses, to

meet the crop requirements. Recently the use of plasticulture or plastic mulch, typically used in conjunction with drip irrigation, has been used to increase soil temperatures. For frost protection row covers, sprinkler irrigation and fogging are typically used, while in extreme cases heaters, smudge pots and fans can be used. Vegetables are also susceptible to heat injury, in warm season crops temperatures between 80-95° F causes injury, while in cool season crops damage occurs between 75-85°F. The type of injury observed in both warm and in cool season crops is premature flowering and crop yields.

In our study, it is clearly been proven that climatic factors mainly temperature, precipitation decide the distribution of ***Phaseolus*** species. Among all ***Phaseolus*** species, ***P.polyanthus, P.vulgaris*** and ***P.coccineus*** are moderately sensitive to low temperature. However, ***P.acutifolius*** and ***P.lunatus*** are found to be highly sensitive to low temperature. Both ***P.polyanthus*** and ***P.coccineus*** are highly tolerant to heavy rainfall. The application of chemicals including abscisic acid, triacontanol, boron, paclobutrazol, uniconizole, and triadimefon protect plants from many stresses including chilling.

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III. MEDICINAL/AROMATIC/ECONOMIC PLANTS AND ITS SUSTAINABLE UTILIZATION

PIII-01 MEDICINAL PLANTS DIVERSITY AND THEIR UTILIZATION BY VILLAGERS IN PUDUKOTTAI DISTRICT OF TAMIL NADU

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Survey and observation was carried out in remote villages of Pudukottai District in Tamilnadu, India for diversity and documentation of medicinal plants used by villagers. Observation revealed that practice of using plants as medicines is still being widely in use not only among the tribal people but also among several others, who have been living in the rural village area of Pudukottai District.

The villagers are traditionally using many plants for medicinal purposes. Out of which 50 plant species comprising 40 genera belonging to 26 families were identified in the present study and their uses were also described. Some of the most widely used plants are *Azadirachta indica, Erythrina indica, Vitex negundo, Citrullus colocynthus, Calotropis gigantea, Aegle marmelos, Albizia lebbeck, Jatropha curcas, Andrographis paniculata, Solanum trilobatum, Aloe vera, Coleus aromaticus, Centella asiatica, Cardiospermum halicacabum, Justicia adhatode, Phyllanthus amarus, Pongamia pinnata.*

These plants were used to cure diseases like wounds, cuts, stomach pain, diabetes, fever, eczema, dandruff, cold, body pain, poisonus bites, urinary stone, etc.. The present study will draw the attention of pharmacologist for further studies and scientific analysis.

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PIII-02 HERBAL COSMETICS USED IN SHAHJAHANPUR DISTRICT, UTTAR PRADESH

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Shahjahanpur district lies between parallel of 27^{o} 35' and 28^{o} 29' N latitude and 79^{o}37' and E longitude in Upper Gangetic Plain of Uttar Pradesh. It is situated in terai belt at the elevation of 182 m mean sea level. The district is an open plain with high state of cultivation. The climate is monsoonic type. The women of the district use the plants and their parts for skin care, care of hands and feet, hair and eyes etc. The women prefer herbal cosmetics as they do not cause any side effects. In recent years in the district much emphasis is being provided to the plants in comparison to the synthetic cosmetics. In the present paper 23 plants have been described. They are arranged alphabetically on the basis of botanical names. The family names along with vernacular names are also given. The plant part used is provided in the last. Out of 23 plants fruits of 14 plants, (*Acacia concinna, Buchanania langan, carica papaya, Citrus lemon, Citrus reticulata, Cucumis melo, Cucumis sativus, Emblica officinalis, Hordeum vulgare, Juglans ragia, Lycopersicon esculantum, Musa paradisiaca, Prunus amygdalus & Sapindus trifoliatus*), seeds of 2 plants (*Cicer arietinum* and *Lens culinaris*) Leaves of 4 plants (*Aloe barbedensis*, *Azadirecta indica*, *Croscus sativus* and *Lawsonia enermis*) under ground stem of 2 plants (*Curcuma domestica* and *Solanum tuberosum*) and flower of one plant (*Rosa damascena*) are used as cosmetics in the district.

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PIII-03 *IN VITRO* STUDIES ON A MEDICINAL PLANT *MARSDENIA TIRUNELVELICA* HENRY & SUBR. (ASCLEPIADACEAE)

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A method is presented for the rapid *in vitro* propagation of *Marsdenia tirunelvelica* Henry & Subr. belongs to the family Asclepiadaceae an endemic, medicinal plant of Western Ghats of South India. The nodal segments were cultured on Murashige and Skoog's medium supplemented with various concentrations of BAP. Best result was obtained on medium containing BAP (0.7 mg/l). The in vitro raised multiple shootlets were cut into single shots and inoculated into ½ MS medium augmented with various concentrations of IBA and IAA. But there is no sign of root formation. The internodes, petiole and leaves wee inoculated on MS medium for callus induction. Petiole explants showed maximum amount of friable callus. Then the callus was transferred to MS medium with various concentrations of BAP and IAA for plant regeneration. There was no regeneration in all the concentration tested.

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PIII-04 IMPORTANCE OF TRIBAL BOTANICAL KNOWLEDGE IN THE CONSERVATION OF MEDICINAL PLANTS

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Tribal Botanical knowledge is a divine gift to mankind. India is rich in herbal resources. Tribals, even today, depend on wild plants and animals for their livelihood. Many tribals live in many parts of our country. Kani is one such inhabited in Agasthiamalai in Tirunelveli hills. In order to find out their Botanical knowledge, an explorative study has been undertaken. From the preliminary survey undertaken in the past four months, it has been found that hundred medicinal plants from 54 families in 72 genera are reported to be used by this tribal group. The Botanical name, vernacular name, family, distribution, description, ethnomedicial and ethnobotanical uses, herbal formulations, compositions are being documented. A data base of Tribal Botanical Knowledge is also being developed. Such study will be useful to understand the role and importance of the TBK in the conservation of medicinal plants of this area.

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PIII-05 LEAF COMPOSITION IN DIFFERENT MUGA FOOD PLANT AND QUALITY OF SILK FIBRE

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Muga silkworm reared on different food plants in different seasons of the year. On the basis of their food plants quality of silk fibres are varied. Among the commercial species *Machilus bombaciyna* (Som) use as primary one. Some other important species are also use as secondary and tertiary. For best quality silk fibre *Litsaea cubeba* (Mejankori) is preferable but last three hundred years Mejankori cultivation completely out of order. The quality and chemical composition of the leaves are compare with *Machilus bombaciyna* (Som) which are acts upon fibres character. This paper highlight about the reutilization of this secondary food plant for the manufacturing quality 'Mejankori fabric' which has a glorious and noble identity during the reign of Ahom administration in Assam.

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PIII-06 MEDICINAL PLANTS SURVEY AMONG THE PRIMITIVE PEOPLE OF VIRUDHUNAGAR DISTRICT, TAMILNADU, INDIA

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Recent developments in modern medicines have benefited humanity beyond his imagination. However, we are also witnessing some serious drawbacks that are primarily due to our over dependence and / abuse of some practices – a classic example being the development of resistance to several antibiotics. Given this alarming situation, world attention is now focussing on alternative sources that overcome there limitations. This has prompted government agencies both at the state and national level as well as multinational companies to pursue efforts aimed at identifying sources that would prove beneficial. Consequently, we come across several studies highlighting the use of plants by primitive people for a variety of purposes. Unfortunately, research as ethnobotanical aspects are very few derpite that fact that Western Ghats belts are inhabited by many tribal groups such as Kani, Malayali, Paliyar and others. Our project work mainly focussed on the primitive people who are living in the slopes of the Western Ghats of Virudhunagar district. In our work nearly twenty two medicinal plants used by the primitive people for the treatment of various ailments are reported.

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PIII-07 EVALUATION OF PHYTOCHEMICAL AND ANTIBACTERIAL PROPERTIES OF *BOERHAAVIA DIFFUSA. L.*

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An attempt has been made to screen phyto chemicals and evaluate the antibacterial activity of *Boerhaavia diffusa*.L., a native medicinal plant. Ethanol, benzene, chloroform, methanol and water extracts of leaf, stem and root were used for phytochemical screening and antibacterial studies. Photochemical studies indicate that the plant parts contain a broad spectrum of secondary plant metabolites like phenols, triterpenoids, antheracene glycosides, sugars, steroids, amino acids etc. Triterpenoids and phenols were predominanty present in benzene, chloroform, ethanol, methanol and water extracts of leaf, stem and root respectively. Antibacterial studies showed remarable inhibition against *Salmonella typhi, Vibrio cholarae, Streptococcus lactis, and Bacillus subtilis.* Root extracts of benzene and chloroform showed strong inhibitory action compared to the extracts of other parts of the plant.

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PIII-08 SUSTAINABLE PRODUCTION AND CONSERVATION OF *ANDROGRAPHIS PANICULATA* (BURM.F.) WALLICH EX NEES. ROLE OF HUMIC ACID

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Andrographis paniculata is an important hepatoprotective medicinal herb belonging to the family Acanthaceae. The effect of humic acid (HA) was studied on growth and andrographolide content, which is the active ingredient of ***A. paniculata.*** Humic acid was applied as foliar spray at different concentrations (0.1%, 0.2%and 0.4%). Plant height fresh and dry weights of shoot and root, leaf area, total chlorophyll, soluble protein, starch, sugars were significantly maximum at 0.1% HA while 0.4% was found to be inhibitory. 0.2% HA also caused an increase in growth but the increase was lesser than in 0.1% HA. Similarly, a significant increase in the andrographolide content was also observed in 0.1% HA treated plants. Hence, it is concluded that the practice of application of HA to ***A. paniculata*** can be recommended for attaining better biomass production andrographolide and sustainable production as the conservation of plants is interlinked to the improvement of plant species.

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PIII-09 EFFECT OF FRUIT SIZE ON SEED GERMINATION IN *AEGEL MARMELOS* L.

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This paper explains the germination ability of seeds from size graded fruits in *Aegle marmelos*. The fruits were collected fresh from two 20 years old trees and size graded in to large, medium and small. The three grades of fruits were subjected to germination. Cent percent germination was observed in seeds from large and medium size fruits in both trees. The lowest germination percentage was observed in seeds from small size fruits in tree 1 and both large and small size with minimum number of seeds in tree no 2.

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PIII-10 THE ROLE OF ETHNOBOTANY WITH REFERENCE TO THE CONSERVATION OF BIODIVERSITY

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Ethnobotany can be defined as the natural and traditional relationship and the interaction between man and his surrounding wealth (Harshberger 1985; Jain 1981). Janakiammal (1985) studied about the food plants of south Indian tribals. Recently "ethnobotany" has been defined as an anthropological approach to Botany (Jain 1997). Biological diversity is of greater importance to many indigenous people as it provides food, fuel, fodder, clothing, medicine, etc. This paper briefly deals with the ethnobotanical aspects of paliyan tribals in Dindigul District.

In Dindigul District, paliyan tribals live in Palani Hills and Sirumalai Hills. The Palani hill tribals are somewhat advanced in their socio-cultural activities by having their own settlements in Thandikkudi, Oothu and in perumal malai areas of palani Hills. However, paliyans of Sirumalai are highly primitive in their life style and are isolated from neighbouring hilly areas and other tribals. palani hills is considered as the original home of the paliyans is a surmise based on the concentration of paliyans are verified by 1961 goverment census.

Generally paliyans are of primitive type and belonging to the pre-drawidian era. They are speaking a highly corrupt form of Tamil in a peculiar accent of their own. The paliyans are short in stature and having archaicf type of nose. Some have felt nose and thick lips. They are generally black (or) dark brown complexian. Since they had nomadic tendencies it is believed that the paliyans who originally lived

as food gatherers in higher altitudes, have moved to the foot of the hills in search of employment as agricultural labourers.

The paliyans are capable of hard manual work and in collecting their food they climb upto any height and walk upto any distance. They live mainly on root tubers (Dioscorea sp.,) and collection of minor forest produce and honey. This paper is discussing the ethnobotanical aspects of paliyans of Dindigul District.

A survey of ethnobotanically important plants has been conducted among the remote villages and tribes of Palani Hills and Sirumalai hills of Dindigul district. Intensive interviews were made with elderly villagers, herbal practitioners and tribals about the medicinal, folk-lore, sacred plants, etc. and their faith relating to the plant resources and their conservation.

Enumertaion of newly reported ethnobotanical plants

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PIII-11 COMMERCIAL MEDICINAL CROPS AVAILABLE IN CUMBUM VALLEY, IN THENI DISTRICT OF TAMILNADU – INDIA

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Plants have been used as healers and health rejuvenators since the dawn of civilisation. The World Health Organization (WHO) estimated that 80 percent of the population of developing countries relies on traditional plant medicines for their primary health care needs. According to Exim Bank the international market of medicinal plants has been dominated by China, which exports 1, 21,900 tonnes a year, and on the contrary, India exports about 36,000 tonnes only.

From time immemorial many medicinal plants are well - known in this country. Use of herbal medicine can be traced to the remote past. One of the oldest treaties in the world is RIG - VED (4500 BC - 1000 BC). Where healing properties of some herbs are mentioned in the form of sonnets, which were often recited in religious rituals. Later on a special faculty was developed known as AYURVEDA, mostly dealing with human philosophy of health including utilization of medicinal plants for restoring normal physical fitness.

The important medicinal plants cultivated in Cumbum valley are as follows citrus (Elumichai), Amla, Karpuravalli, Amukkara - Kizhangu, Curry pala, Sangupushpam, Amanakku, Pudina, Kadukkai, Kasinikeerasi, Lavangapattai, Clove, Thuththi, Simaiathi, Karisalai, Pirandai, Vallari, Brahmi and Keelanalli.

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PIII-12 SURVEY OF ETHNOMEDICINAL AND AROMATIC PLANTS IN MARUTHAMALAI FOREST

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This contribution is the outcome of thorough and critical examination of utility of some medicinal herbs used by the tribal locality of Maruthamalai hills, Coimbatore district, Tamil Nadu. In the present investigation, a total number of 35 plant species belonging to 31 different families is enumerated and documented. The ethnomedicinal information pertaining to name of the species and the family in which it belongs name, and the part of the plant species which being utilized as ethnomedicine is also provided. Six of plants are used to treat skin disorders; fourteen species are exploited to treat common ailment like toothache, headache, earache and diarrhoea or used as laxative diuretic and vermifuge. Specifically the plant species like ***Albizia lebbeck* L.** willd; ***Naringi crenulata* Roxb. Nicolson; *Acalypha fruticosa* Forssk; *Thespesia populnea* L.** Soland are used as antidote and the *Abuitilan indicum* Linn. Sweet; ***Celosia argentea* L.; *Clitoria ternatea* L.** are employed to treat genital diseases. The species like ***Dodonaea viscosa* L. Jacq; *Cassia occidentalis* L.** are utilized to treat veterinary disorders / diseases.

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PIII-13 HAIRY ROOT PRODUCTION -A NEW APPROACH TO SAVE THE GERMPLASM OF A RARE MEDICINAL PLANT *PLUMBAGO INDICA*

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Plants produce an array of natural products, the so-called secondary metabolites that are also important to man as a source of pharmaceuticals, fragrances, agrochemicals and food additives. It is noticed that most of the medicinally important plants possess their bioactive constituents within their roots.

Plumbago indica (syn *rosea* Family – Plumbaginaceae), currently listed under "rare" plant category is the best source of plumbagin, a natural naphthoquinone, showing important pharmaceutical properties like anticancer, antimicrobial, cardiotonic, antifertility etc. Main drawbacks associated with utilizing

plumbago indica roots as a source of plumbagin are mainly unavailability of sufficient quantity of plant materialcaused by over collection from wild, poor rate of natural regeneration, slow growth nature of the plants, taking too long time to mature and lack of any systematic cultivation system. An alternative means for production of roots may therefore help the situation. Propagation of desired plants and plant organs at fast rate is possible exploiting in vitro culture techniques and hairy root culture is one of such techniques that can be used for the purpose.

In our present study we have established hairy root culture, using *Agrobacterium rhizogenes* (strain ATCC 15834) and obtained 100% positive response while infection was made in mature leaf lamina of micropropagated plants.. The important observation made in this respect is that, besides the particular area of infection, hairy roots were found to grow from different sites of the green lamina. Roots grew vigorously with dense hairs yielding a significant quantity of root biomass within four weeks starting from their emergence. Fast-growing clones of hairy roots, after screening were cultured in liquid MS medium containing 3% sucrose in absence of growth hormone. Presence of root inducing plasmid gene (rol B) was confirmed by PCR technique. Plumbagin content was detected and estimated in hairy roots using HPLC method and found to be present at higher quantity in comparison to non-transformed roots.

Hairy root culture for developing an alternative source of plumbagin may help in sustainable use of the plant leading to its natural conservation and in increased production of the compound without creating pressure on natural resource. In over populated countries like India development of additional source of this herbal compound is also important in birth control studies.

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PIII-14 HERBAL THERAPY FOR CURING PILES IN SHAHJAHANPUR DISTRICT, UTTAR PRADESH

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During a course of study of medicinal plants in the district, it is learnt that various diseases can be cured with very nomial doses of the parts of the plants, The disease, Piles is very common among the urban people and villagers also. For the first time a comprehensive account on the therapeutic efficiency of several plants have been collected. The disease piles occurs due to intestinal disorders. The disease is of two types (i) dry piles and (ii) bleeding piles. The piles gives a painful situation during defaecation.

The authors visited several villages and interviewed certain herbal practitioners, vaidyas, hakeems and old people. The plants as narrated by the herbalists were collected and identified.

The authors also conducted dialogues and discussion to know the causes of piles. During our course of study we have enlisted 30 plant species from the district. The plants are arranged alphabetically

on the basis of botanical names. The family name and vernacular name of each plant are also given. The detailed information of mode of administration is also furnished in respect of each plant. The present findings may help those victims who are suffering from the disease. The present knowledge may help to establish a drug industry. The enumerated plants are as- *Achyranthes aspera* L. (Leaf juice), *Aloe barbadensis* Mill. (Pulp of leaf), *Amorphophallus campanulatus* (Roxb.) Bl. (Tuber), *Averrhoa carambola* L. (Ripe fruit), *Bauhinia variegata* L. (Dried buds), *Boerhaavia diffusa* L. (Whole plant), *Calotropis gigantea* Ait. (Latex) *Citrus limonum* Riso. (Juice of fruit), *Cynodon dactylon Pers.* (Whole platn), *Dioscorea bulbifera* L. (Tuber), *Emblica officinalis* Gaertn. (Powder of fruit), *Ficus racemosa* L. (Juice of stem), *Gloriosa superba* L. (Root), *Mimosa pudica* L. (Powder of leaf), *Mimosa rubicaulis* Lam. (Leaves), *Momordica charantia* L. (Fruit), *Momordica dioica* Roxb. (Root), *Nelumbo nucifera* Gaertn. (Filament and root), *Nymphaea pubescens* Willd. (Powdered root), *Nymphaea rubra* (Filament), *Phaseolus radiatus* L. (seeds), *Plumbago zeylanica* L. (Root), *Pongomia pinnata* (L.), Merr. (Young leaves and Fresh bark), *Raphanus sativus* L. (Root), *Sesamum indicum* L. (Seeds), *Solanum nigrum* L. (Whole plant), *Tagetes erecta* L. (Juice of flower), *Tephrosia purpuria* Pers. (Leaves), *Terminalia belerica* Roxb. (Fruit), *Zingiber officinale* Rose. (Dried rhizome)

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PIII-15 PLANT TWIGS AS TOOTH BRUSHES AND THEIR MEDICINAL USES IN PILIBHIT DISTRICT UTTAR PRADESH INDIA

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Pilibhit district is situated in the terai belt of Upper Gangetic plain. The district is an open plain with few forest ranges scattered in the district. The soil of the district is generaly alluvium brought by the rivers. Author visited several villages and interviwed the oldmen, vaidyas, hakims, ojhas, sadhus etc and collected information about the use of plant twigs as brush. Fesh tender twigs of a few plants are found suitable to use for brushing the teeth and cleaning the tongue. One end of the twigs is crushed to make it brush like. Such toothbrush is used to clear the decaying teeth, to stop bleeding of gums to treat severe toothache pyrrhoea etc. Authors observed that villagers usually use fresh twigs of plants early in the morning every day cleaning the teeth. Plant twigs is commonly known as daton in rural areas. Total 21 plant species have been reported in the present investigation. They belong to 16 families. The plants also have medicinal value e.g. Astringent used in skin cleaning (*Abutilon indicum* (L) std, *Acacia catechu* Willed, *Acacia nilotica* (L) Willed ex Del, *Bauhinia purpurea* L., *Psidium guajava* L., *Zizyphus nummularia* (Burm. f.) W.S.A.), Antipyratic used in pain (*Tinospora cordifolia* (Willed) Miers), Anthalmentic used in worms (*Punica granatum* L.), cololing (*Emblica officinalis* Gaertn), ematic used for vomiting (*Dalbergia sisso* Roxb), hypoglysanic used in diabetes (*Achyranthes aspera* L. ,

Azardirachta indica A. Juss, *Ficus bengalensis* L., *Syzygium cumini* L.), haemorhoea (*Mangifera indica* L.) In intermitent fevers (*Aegle marmelos* (L.) Corr.), rheumestism used in joint pain (*Holeptela integrifolia* (Rexb) Planch), in toothache (*Minusops elengi* L., *Streblus asper* Lour), used in Jaundice (Kriganelia reticulata (Poir) Baill.

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PIII-16 MEDICNAL PLANT DIVERSITY AND UTILIZATION OF LOWER PALANI HILLS, SOUTH INDIA

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The Palani hills are an Eastward offshoot of Western Ghats of India with an area of 2,068 Km^2 .These group of hills fall into two geographically distinct zones such as upper Palanis and Lower Palnis. Upper Palanis are belonging to Western Ghats and Lower Palanis are categorized under Eastern Ghats. Lower Palanis constituted an area of 1,683 Km^2, altitude below 1,800m with a more rugged landscape, consists of typical vegetation between slopes and valleys. Most of the area of these forests are highly degraded and converted into cultivable lands. Natural forests are fragmented and limited vegetations only remains in the forest valleys. Foot hills of the forest constituted with thorny scrub vegetation up to 450 m. above 500 m forests are covered the deciduous type with multistoried vegetation. Altitudes between the 1300-1700 m, consists of dry ever-green forests. All these forests are serving a habitat for more than 250 common medicinal plants belonging to 96 families. Most of these species are used in codified Indian medicines like Siddha, Ayurveda and Unani. Several medicinal plants are being collected for trade purpose. The present study investigated the utilization of medicinal plants by the local inhabitants of lower Palani hills. This study resulted that 118 medicinal plants used for primary health care by natives of lower Palani hills. Numbers of medicinal plants are in the verge of extinction due to overexploitation and continuous extraction of plants from the natural habitat. Some species are used as common medicine in their local healing regularly like *Andrographis paniculata* (antidote), *Asparagus racemosa* (diuretic), *Entada pursaetha* (rheumatism) and *Plumbago zeylanica* (antifertlity). Current trend in an increasing interest in the phytochemical and pharmacological exploration based on traditional knowledge is also leading the threatening of medicinal plant diversity. Conservation of biodiversity and the germplasm of important medicinal plant species have assumed global significance from the point of view of ecological security and for ensuring a secure livelihood.

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PIII-17 SUSTAINABLE HARVESTING AND ADAPTIVE MANAGEMENT OF MEDICINAL PLANTS/NTFPS

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Medicinal plants comprise a minute proportion of the needs of modern humanity, contributing to 0.16% of India's economy, providing seasonal livelihoods to about 1% of the population, from the hills and remote arid plains. Society may not actually care for their sustainable use and equitable benefit sharing. For, loss of medicinal species is paltry, as many other species or synthetic substitutes exist. Sustainable use regimes never evolve well even regarding more precious commodities such as timber, bamboo, fuel wood, fodder etc. that accounted for up to 10% of the economy. Substitutes include either imports as with timber and bamboo or cultivation as with fuel wood and fodder.

Models of sustainable use of medicinal plants are scarce due to (a) poor price and returns compared to high present economic needs (b) lack of security of the tenure to local community or forest guards, which makes long term benefits realization impossible (c) many options of species or technology making the species dispensable. Medicinal plants would be next to go economically extinct from the wild, even if persists biologically in many small populations, which are economically unviable to harvest. Their cultivation rarely yields chemical efficacy, due to absence of causal stresses such as pest attack or drought or soil poverty, as in the natural conditions.

Despite above difficulties, eco-friendly harvesting methods have been initiated in few places that posses relatively secured (a) demand, (b) price or (c) tenure. Such favorable conditions can promote (1) less damaging (to the plant harvested) product (2) less damaging (to the plant population harvested) method (3) quantity and time confined to maturity and (4) good quality. Above all, (5) the purpose to needs to be quick local community income generation rather than any delayed sharing of external profits for a few persons. Models based on such distant or delayed believing benefit sharing neither conserved the resource nor traditions, as with the Kani tribals of Kerala state. The trade in genuine traditional cure such as Tulsi (*Occimum sanctum*) continues, but not the collection or cultivation of greed or hype based species such as (*Chlorophytum spp.*).

Experiences of Gram Moolige Company Limited (GMCL, www.villageherbs.com) collection in fallow farms and wastelands of Tamil Nadu endorse above 5 postulates. GMCL is a trading collective owned by the gatherer groups, marketing about 15 species. None of the species collected declined consistently across the last 5 years, but quantum varied erratically, depending upon rainfall. These annuals grew well next year even if heavily harvested, provided after the seed-fall. The collective trade won their support by reducing drudgery of transport and market wait but could not provide higher prices as hypothesized earlier. Good quality product may fetch higher price only sometimes.

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PIII-18 BIOMASS PRODUCTION OF VETIVER (*VETIVERIA ZIZANIOIDES)* USING VERMICOMPOST.

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Vetiver grass (*Vetiveria zizanioides)* is an 'ecological climax' species. It is called as a 'Miracle grass'. Vetiver can survive months of drought or up to 45 days of flooding. It can be grown at temperature as low as -9°C and as high as 45°C. It thrives in sea-level marshes and on mountains 2,600m high. It flourishes in both acidic (pH 4.5) and alkaline (pH 10.5) soils. Vetiver has positive effect on crops in its vicinity. Because it is virtually sterile, it never becomes a weed or spreads out of control (National Research Council, 1993). Vetiver has a strong fibrous root system which rapidly penetrates deep into the soil and develops into a tightly knitted net. It holds the soil together and serves as an underground wall which not only retards water flow but also allows it to seep into the soil. The roots are also capable of absorbing mineral nutrients for plants and other chemical substances like chemical fertilizers or pesticides before they flow into the water sources, thus protecting water from pollutants and maintaining the water quality. It has almost no enemies. Snake, rats and other pests dislike it.

Vetiver is cultivated as a relay crop. The vetiver has high nutritive value for Dairy cattle and Beef fattening animals. The goat and sheep herders also use the fodder as popular forage. The animals with other balanced feed and vetiver show a remarkable gain body weight within a short period. Small scale farmers benefit both socially and economically. The cultivation of vetiver helps in arresting soil erosion and fertility of the land which gives environmental protection. So the socio-economic value of vetiver is quite satisfactory for the poor farmers.

The leaves are used in basketry and mat weaving and also make an excellent roof thatching. The fragrant roots are woven into screens and fans and other household items. An essential oil is steam-distilled from the dried, chopped roots known as Vetiver oil.It is thick and amber in colour. It is extensively used as a fixative in perfumery. The scent is deep, earthy and woody with an almost lemony overtone and is very tenacious.

It is used in aromatherapy to help relieve stress and to promote relaxation. The world production of vetiver oil is about 250 tons a year. The oil content of the root in average is 1.5% (range 0.7 – 2.3%) and about 17000 tons of roots per year are required for the above. It seems unlikely that demand will increase beyond these figures, even to match population growth. Since there is a great demand for vetiver, the present study is focused on the enhanced production of vetiver by using the different substrate for the growth of vetiver. In the present study, the vetiver is grown using soil, cow dung, and vermicompost at different ratio of 1:1, 1:1:1, respectively. Appropriate controls were maintained. The weight and length of the root and shoot were taken on 45th and 90th day. The 90th day results showed that the ideal combination for the growth of the vetiver is soil: cow dung: vermicompost and the maximum root length, shoot length, the fresh weight and dry weight of the root were 41cm, 90cm, 44.55 g, 11.78g respectively.

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PIII-19 STUDIES ON THE POTENTIATING / PROTECTIVE EFFECT OF CURCUMIN IN ALLIUM CEPA ROOT TIPS.

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Curcumin, a major component of the spice turmeric (Curcuma longa.L.–Zingiberaceae). Turmeric has been used in Ayurvedic medicine as a **"Cleanser of the body**" and used in Chinese medicine also. Curcumin a natural Phenolic compuound is gaining importance as a Free radical Scavenger. Recent studies showed that Curcumin has the properties such as antitumor, antioxidant, anticlastogenic and cytostatic in *in- vitro* cultured and *in vivo* cells. At the same time curcumin at higher concentration (>10µg /ml) caused chromosomal damage in *in vitro* cell cultures. So far there is no report on antigenotoxic or genotoxic effect of curcumin in plant test systems. In the present investigation, we want to analyze whether curcumin has protective or potentiate the clastogenic effects in Allium Cepa root meristem, post treated with mutagen.

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PIII-20 LARVICIDAL AND BACTERICIDAL POTENTIAL OF *CASSIA SENNA'S* METABOLITE

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Mosquitoes are the vectors of several diseases, malaria, filariasis, dengue and yellow fever etc., and accounts for millions of death annually in the world. The control of mosquitoes by conventional synthetic insecticides has not been much effective in recent time due to development of behavioral and physiological resistance in them. There is considerable interest in developing natural products as alternative to non-selective synthetic pesticides to control invertebrate pests of medical and economic importance.

Plants offer unique protection to mankind by providing a number of drugs to prevent and treat various disorders. It is estimated that today the plant materials provide the models for 50% of western drugs (Robbers *et al* 1996). The preliminary benefits using plant-derived medicines are that they are relatively safe than the synthetic alternatives, offering profound therapeutic benefits and more affordable treatment (Iwu *et al* 1999). Though the medicinal property of a large number of plants is already known to man there still exists an enormous number in the plant kingdom which has not been analyzed for their medicinal properties. Over the last 20 years a large number of plant species have been evaluated for their antimicrobial activity (Castello *et al* 2002).

In the light of above explanation *cassia senna* medicial plant was selected based on ayurvedic literature to evaluate its larvicidal and bactericidal properties. From its extract a secondary metabolite was isolated and identified by IR and NMR methods. At chosen concentrations its effect was studied against nine gram – ve and gram +ve bacteria as well as CX. quinquefasciatus mosquitoe larvae. Results obtained based on this study will be presented.

POSTER SESSION II

IV. MICROBIAL BIODIVERSITY AND ITS ROLE IN SOIL PROCESSES

PIV-01 ASSESSMENT OF GROWTH, NODULATION AND BIOMASS PRODUCTION OF *LEUCAENA LEUCOCEPHALA* (LAM.) DE WIT. IN DIFFERENT STRESSED SOILS

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Agro forestry practices involving growing of crop plants together with perennial nitrogen fixing trees have become important to conserve biodiversity and prevent the development of global warming. Improvement of soil fertility and afforestation of wastelands leading to the reclamation are important to produce and protect the vegetation cover from the angle of sustenance of future life. Leguminous trees and shrubs are a renewable source of fuel and wood and many are known to have symbiotic association with rhizobia that fix atmospheric nitrogen, and so can help in increasing the fertility of soil. *Leucaena leucocephala* is one such tree found in dry tropical regions and semi arid regions. It is renowned for its fast growth even on marginal lands and is a popular plant for use in land rehabilitation programmes (Baunarri, 1996). Since the rhizobial symbioses in leguminous trees play a vital role in nitrogen fixing and enhancing the soil fertility, they are well adapted for the reclamation of unproductive and barren lands (Rajasekar *et al*., 2000). *Leucaena leucocephala* is an ever green leguminous tree known for its rich source of protein and is the most effective one to be grown on waste /barren lands because of its high nitrogen fixing ability and fast growing capacity (Gaevarra *et al*., 1978). The present study focuses on the effect of different soils such as dye industry effluent soil, dry land soil, saline soil and calcareous soil on the growth and nodulation of the tree legume *Leucaena leucocephala*. The stressed soils selected for the present investigation were dye industry effluent soil, dry land soil, saline soil and calcareous soil. Virgin soil collected from a forest area served as control. Seeds of *Leucaena leucocephala* were surface sterilized with 0.1 percent mercuric chloride for 10 min, washed thoroughly with sterile water and sown in earthen pots. Plant growth and physiological and biochemical parameters were analyzed in 90 day old seedlings. Growth characteristics like height and fresh and dry weight of root and shoot were measured. Efficiency of nodulation was assessed by taking the number and fresh and dry weight of nodules. Chlorophyll content (Arnon, 1949), soluble starch (Mc Cready *et al.*, 1950), soluble sugar (Dubois *et al*., 1956), proteins (Lowery *et al*., 1951), proline (Bates *et al.*, 1973) and nitrate reductase activity (Muthuchelian, 1989) were assayed.

Among the selected stressed soils, the growth and nodulation of *Leucaena leucocephala* was better in the dye industry effluent soil and moderate in the saline soil followed by the dry land soil. In the calcareous soil, the growth and nodulation were very poor compared to control. Nodulation was seen in all the stressed soils at a reduced level in comparison to the organic matter rich soil. The stressed soils caused a general reduction in growth characteristics, photosynthetic pigment content and metabolites like protein, starch and sugars. Proline showed increased accumulation in plants grown in these soils. Reduction in nitrate reductase activity was also observed in all the stressed soils.

Among all the tested stressed soils, minimum reduction in growth and nodulation were observed in dye industry effluent soil. In saline soil and dry land soils, the growth and nodulation were significantly reduced while in calcareous soil it was very much significant and the reduction was maximum. Although the soils are stressed in nature, the symbiotic relationship of *Rhizobium* with *Leucaena leucocephala*, the tree legume, was noticed which suggested the presence of various stress tolerant strains in natural condition.

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PIV-02 IMPLICATED ROLE OF FUNGAL GROWTH IN AERIAL ROOT DYNAMICS OF *ACAMPE PRAEMORSA* (ORCHIDACEAE)

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Forest canopy studies related to epiphytes are gaining much scientific attention due to the complex ecological dynamics involved. The role of free hanging roots of epiphytic orchids in water abosrption from the atmospheric moisture had been much interpreted. However, the conditions that shape dynamics of free hanging epiphytic roots are not much understood. In the present study an attempt has been made to identify the factors involved in aerial root dynamics. *Acampe praemorsa* (Roxb.) Blatt. & McCann, an epiphytic orchid species, with free hanging aerial roots has been selected for the study. Twenty roots of three individuals were selected, labeled and observed for length and other observable parameters. The observations were carried out every fortnight from June to November covering the last leg of pre-monsoon, monsoon and post-monsoon periods. It is observed that the root started growing only with the onset of monsoon and stopped growth during the post monsoon. During monsoon, between the showers, the root tip was seen covered with film of water in which some mycelial growth was observed. Presence of fungus has been confirmed by isolating the fungus and growing it in culture. Microscopic observations of transverse sections of root tips stained with cotton blue also confirmed the associated fungal growth. Further observations showed that the external fungal growth disappeared if the gap between two rainfall events is considerable. Based on these observations the role of fungus in growth dynamics of free hanging roots of epiphytic orchids is implicated.

PIV-03 EFFECT OF ABIOTIC FACTORS ON SOIL RESPIRATION IN A SEMI-ARID ECOSYSTEM, MADURAI, INDIA

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Seasonal patterns of soil respiration with litter and without litter were measured at three sites in a semi-arid eco climatic region, Madurai, India. The CO_2 evolution rates for the three sites were : *Leucaena leucocephala* plantation 149.62 - 95.92 mg CO_2 m^{-2} h^{-1}; *Albizia lebbeck* plantation 161.70 - 84.90 mg CO_2 m^{-2} h^{-1}; grazing land 253.70 - 17.96 mg CO_2 m^{-2} h^{-1}. There was no significant correlation between soil respiration and rainfall. A positive significant relation existed between rate of CO_2 evolution and mean air low temperature (r = 0.421 - 0.752), and between soil respiration and mean high relative humidity (r = 0.716 - 0.895). A statistical model developed on the basis of the relationship between CO_2 evolution and meteorological factors showed 0.508 - 0.889% and 0.825 - 0.904% of the variation with litter and without litter respectively, for any site. The relationships between soil respiration and soil water content and temperature were examined by a simple and multiple linear regression analyses. The second degree polynomial of soil temperature included in multiple regressions failed to improve the significance of any of the regressions.

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PIV-04 INFLUENCE OF SOIL TYPES AND SOWING DEPTH ON SEED GERMINATION OF MAHOGANY (*SWIETENIA MAHOGANY*)

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The present investigation deals with the soil types and sowing depth on the germination of mahogany seeds. The medium size seeds excelled over other grades with respect to all the germinability attributes irrespective of the experimental conditions. Among the seven soil media the seeds sown in sand + red soil + humus and red soil + sand media were found to exhibit best germination. The best sowing depth for better germination was found to be between 1 to 2 cm depth in all l size of seeds.

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PIV-05 BIO-CONTROL BY *GLOMUS MOSSEAE* VC1 AND *PSEUDOMONAS FLUORESCENS* MKU3 AGAINST *FUSARIUM OXYSPORUM* (WILT) IN CLUSTER BEAN

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The naturally available soil bioresource (VAM) is used as a bio-control here against wilt disease. A green house experiment was carried out in the vegetable crop Cluster bean (*Cyamobsis tetragonoloba* L*)*. The interaction between *Glomus mosseae* VC1 and *Pseudomonas fluorescens* MKU3 against *Fusarium oxysporum* and their effect on mycorrhizal establishment, plant growth was determined in Cluster bean after 40 days of growth and yield was studied after 60 days of growth. However, the dual inoculation with these two organisms improved the mycorrhizal infection 88% in Cluster bean. In contrast, *F. oxysporum* inoculated Cluster bean showed less infection.

Inoculation of *F. oxysporum* when developed in Cluster bean, the root and shoot length and dry matter of the plant was significantly reduced than control. In the presence of *P. fluorescens* MKU3 and *G. mosseae* VC1 infected by *F. oxysporum* showed reduced root rot index in Cluster bean. These results suggested that *P. fluorescens* MKU3 exhibited a strong effect on *F. oxysporum*. Therefore, the presence of *P. fluorescens* MKU3 in the rhizosphere of mycorrhizal plants showed an additive effect on the suppression of Fusarium wilt as evident from the reduced root rot index. However, the *F. oxysporum* infection in Cluster bean affected plant growth and nutritional status of the plant and significantly reduced the total chlorophyll, phosphorus and nitrogen content in 40 days. In contrast, the inoculation of *P. fluorescens* MKU3 to the mycorrhizal plants exhibited cumulative effect on the improvement of plant growth and total chlorophyll, total phosphorus and nitrogen content in Cluster bean plant.

The yield parameters of the dual inoculated (*G. mosseae* VC1 and *P. fluorescens* MKU3) Cluster bean plants infected with *F. oxysporum* were studied. *F. oxysporum* infection in Cluster bean decreased pod number, pod dry weight, and seed dry weight. In contrast, the dual inoculation of *G. mosseae* VC1 and *P. fluorescens* MKU3 increased the pod number pod dry weight and seed dry weight than single organism inoculated Cluster bean plants.

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PIV-06 STUDIES ON THE FOREST FLOOR LITTER OF PIRANMALAI FOREST, EASTERN GHATS, TAMIL NADU

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In terrestrial ecosystems, a major portion of the energy fixed by green plants in net primary production makes its way to the soil in the form of dead organic matter (Odum, 1971). The plant debris constitutes an active and important component of the soil and influences to a large extent the processes of nutrient cycling in forest ecosystems. The studies on forest floor dynamics have been carried out in a number of forest ecosystems either using field incubation litter bag techniques to measure loss in mass and nutrient release from litterfall components (Gosz *et al.,* 1973) or by estimating nutrient turnover rates from dry matter and nutrient contents in litterfall and forest floor litter (Reiners and Reiners, 1970). The floor litter in each study site of the forest was sampled at 10 points randomly located within an experimental area of 30 x 30 m. All the litter above the mineral soil within a 1 x 1 m quadrate was collected. Collections were made at monthly intervals from January to December, 2003. Litter was sorted into the fractions of leaves, twigs, miscellaneous and fruit compartments. The samples were oven dried at 60°C for 48 hours and weighed. The decomposition co-efficient for each forest type was calculated by using the formula of Olson (1963).

The study site V stand forest was characterised by higher annual litter accumulation (274.98 g/m^2) followed in the decreasing order by site VI stand forest (274.91 g/m^2), site III stand (258.26 g/m^2), site IV stand (247.67 g/m^2), site I stand (174.60 g/m^2) and site II stand (166.47 g/m^2). The forest floor litter accumulation showed the maximum during winter and summer months and the minimum during rainy months in all the six study forest site stands.

The standing crop of litter in the present study sites stand (166.47-274.98 g/m^2) is comparable with those of other tropical forests. It is known that the annual average value of the standing crop accumulation for the study forests falls within the reported range of tropical deciduous forests. The decomposition coefficient is a useful ecosystem constant varied according to the type of material which undergoes decomposition. The leaf component generally had more decomposition coefficient (>3). The annual decomposition rate was high (1.97 for site VI and site III stands, 2.02 for site V stand, 2.06 for site IV stand, 2.15 for site II stand and 2.17 for site I stand) when compared to those observed in other forests.

The nutrient concentrations in the floor litter varied between months and taxa. It showed a regular trend of increase during dry months and decrease during rainy months. The accumulation of nutrients in the biomass of forest floor litter also showed similar trend as observed in nutrient concentration. The leaf compartment of the forest floor litter accumulated more nutrients in comparison to those in other parts of the litter. Further, it is known that the turnover rate of nutrients for leaf litter compartment was higher than that of other litter parts.

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PIV-07 LITTER DECOMPOSITION AND NUTRIENT DYNAMICS OF PIRANMALAI FOREST, EASTERN GHATS, TAMIL NADU

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Litter decomposition is an important process in the functioning of the soil-litter decomposer sub-system (Swift *et al.*, 1979). Leaf litter is an important component of the soil matter, which contains a substantial amount of nutrients in the form of organic molecules (Byard *et al.*, 1996). Cycling of organic matter through litterfall and its subsequent decay are important mechanisms of soil restitution and plantations. Further, considerable amounts of nutrients are also returned to the soil through the litterfall and made available for reabsorption (Kumar and Deepu, 1992; Scott *et al.*, 1996).Many conceivable hedgerow tree species like *Albizia lebbeck* and *Cassia* etc., are found to restore soil fertility in agroforestry system. *Wrightia tinctoria* meets the necessary criteria for successful hedgerow tree with rapid growth rate, large store of nutrients, and rapid rate of decomposition and release of nutrients (Rogers *et al.*, 1996). Although *Wrightia tinctoria* is a well-known tree species for a year now, very little is reported about the litter dynamics and nutrient cycling in India. It is based on this background that the present study was undertaken with the following objectives.

To determine the rate of decomposition of leaf litter of *Wrightia* species under dry deciduous ecosystems.

1. To assess the nutrient release of *Wrightia* leaf litter during the decomposition.
2. To establish the relationship between mass loss and environmental and edaphic factors.

The litter bag technique of Gupta and Singh (1981) was employed for studying litter decomposition rates. The sample leaf material selected for the study was from the dominant species *Wrightia tinctoria* from all the six study sites. The litter was collected during the period of peak litter fall (December 2003) by placing large polythene sheets under the vegetation at several points within a 30 x 30 m plot in each site In each forest type, the periodical residual litter mass of three replicate samples were drawn for each chemical analysis. The concentrations of total nitrogen, organic carbon and lignin were analysed in the initial and decomposing litters.

In the present study, the decomposition period was slightly varied across the study sites of forest. In the sites I, III and IV stand forest litter decomposed within a period of nine months, site II stand forest litter decomposed within a eight month period and sites V and VI stand forests litter decomposed within a short period of seven months. The decomposition rates, reported in this study, are comparable to that of tropical forest studies. In all six study sites the rate of litter decomposition was faster. The litter decomposition was faster during the initial period followed by the slower and steady state. The process of decomposition was influenced by number of variables. The initial concentrations of certain chemical substances such as nitrogen and water soluble compounds are negatively correlated with the time required for decomposition. On the other hand, the high initial lignin concentration and the initial lignin/nitrogen ratio increased the period of decomposition. The concentration of chemical substances was changed in

the decomposing litter and it is depending upon the nature and availability of chemicals. The concentration of carbon decreased in the decomposing litter as the process proceeds and contrary to this the lignin concentration increased. The leaching of water soluble compounds was greater during the initial period. The C/N ratio of the decomposing litter was higher during the initial period and declined in the later period of decomposition. The biotic variables such as population of bacteria, actinomycetes and fungi were also decreasing during the course of decomposition.

Decomposition of litter is regulated by a host of variables including the litters' physical and chemical properties, habitat and macro and micro faunal responses. If these, the substrate quality and climatic conditions are the two major factors controlling the decay process. The regression analysis also indicates that the factors such as soil pH, soil moisture, rainfall, rainy days, and water soluble compounds in litter, number of colonies of bacteria, actinomycetes and fungi have significant positive influence over the decomposition in all six study forest sites. The other variables such as temperature have negative influence over the process of decomposition.

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PIV-08 MICROBIAL EFFECT ON FERMENTATION PERIOD ON *GUNDRUK* AND *SINKI* – AN INDIGENOUS FERMENTED VEGETABLE PRODUCT

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Gundruk and *Sinki* are the fermented products of fresh mustard leaves (*Brassica juncea* var. *rugosa*) and radish (*Raphanus sativus*. L) respectively. It is an indigenous food mainly used by the Nepalese community of Manipur. A total of ten (10) fungi, a yeast (*Trichosporan asahii*) and two bacteria (*Bacillus pantothenticus* and *Bacillus pumilus*) were isolated from the fermented products. Some of the dominating microbes were *Aspergillus glaucus, Aspergillus brassicae, Cladosporium brassicae, Aerobasidium pullulans, Trichosporan asahii, Bacillus pantothenticus* and *Bacillus pumilus*. Maximum number of microbes is observed on 30 days fermentation period and least on 10 days fermentation period.

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PIV-09 PHYTOREMEDIATION OF ZINC BY *SPIRODELA POLYRRHIZA* (L) SCHLEIDEN

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Industrial development coupled with population growth resulted in the over exploitation of natural resources. Life support systems viz, water, air, soil, thus getting exposed to an array of pollutants especially heavy metals released by anthropogenic activities. Tolerant species of aquatic plants are able to survive and withstand the pollution stress and serve as pollution indicator and as a tool for phytoremediation of toxicants from the aquatic ecosystem. Phytoremediation is an environmental cleanup strategy in which selected green plants are employed to remove environmentally toxic contaminants harmless. This is an emerging biogeotechnological application based on"green liver concept" and operates on the principles of biogeochemical cycling. This paper would focus the relevans of phytoremediation technology for cleanup of metals in water for sustainable development by the use of floating aquatic macrophytes.

Laboratory experiments were conducted to assess the efficiency of aquatic macrophyte- *Spirodela polyrhiza*, as a phytotool for the remediation of the zinc from synthetic effluent at the interval of 4 days for 12 days. Results show upto the concentration of 30 ppm, *Spirodela* removed zinc from the media by absorption and adsorption. The rate of remediation is significant with respect to time interval. However, maximum removal of zinc continued upto 4th day, only marginal increase thereafter. Phytoremediation efficiency of *Spirodela* is significant with respect to the exposure concentration at 4th day. *Spirodela* shows the symptoms of toxicity at the exposure concentration of 40 and 50 ppm for 12 days. However, they donot exhibit symptoms of toxicity at lower concentrations. Results confirm the removal of maximum quantity of zinc by *Spirodela* within four days of exposure. *Spirodela* serves as a phytoremediation tool for the extraction of the zinc from synthetic effluent. Regular harvest of the plant at the interval of four days helps to clean aquatic environment. Harvested biomass may be used for composting.

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PIV-10 ISOLATION AND IDENTIFICATION OF CYCLOSPORINE PRODUCING FUNGI, FROM WESTERN GHATS, TAMILNADU, INDIA

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The fungal kingdom had enormous biodiversity, with around 70,000 known species, and an estimated 1.5 million species in total. They are known for their production of enzymes and secondary metabolites, in which man has exploited many of them. The best-known fungal secondary metabolites in commercial production are the β-lactam antibiotics, produced for over 50 years, with continuous strain and fermentation improvement.

In this view, 600 soil samples were collected from different places of shola forest ecosystem, Western Ghats (Latitude $10^0$12' N Longitude 77^0 30' E) of Tamilnadu, India. Cyclosporin producing fungal colonies, *Tolypocladium sp.*, was screened and microscopic and morphological characteristics were compared with reference MTCC strain of *Tolypocladium inflatum* (MTCC-989). The isolated fungus, *Tolypocladium sp.*, has showed three-fold increased in cyclosporin production. Genetic analysis of secondary metabolic pathways over the past 10 years has revealed some common themes and offered new approaches to the exploitation of natural products.

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PIV-11 SURVEY OF VAM FUNGI IN SOME RARE, ENDANGERED, THREATENED AND ENDEMIC TREE SPECIES

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Plants with vesicular arbuscular mycorrhizal (VAM) association have many advantages over non mycorrhizal plants. The effectiveness of such "VAM" host symbiosis id determined by the interaction between fungus, host plant and soil. Rhizospere soil and root samples of 22 plants of rare, endangered, threatened and endemic plants are collected. Samples were taken form natural habitats in Dharwad district of Karnataka. Percent VAM colonization and spore number were counted. The mycorrhizal status of examined plants belongs to families Rutaceae, Rubiaceae, Leguminoseae, Myrtaceae, Verbenaceae, Combertaceae, Rhamnaceae, Teliaceae were arboured VAM fungi in their root system. Lower percentage of VAM was recorded in Santalaceae, Bombacaceae, Nyctaginaceae. The mycorrizal

spore number in root zone ranged from 139-146/50 g soil. Maximum spore number (181/50g) was observed in the root zone of *Gmelia arborea, Madhuca longifolia, Adina cordifolia*.

In four rare plants *Pterocarpus marsupium, Madhuca longifolia, Sygizium cumini* and *Carissa carandus*. Month wise distribution of spore was fluctuated. The spore population was low in summer, maximum in three plants. Highest spore number was observed in May in the rhizosphere of *Pterocarpus marsupium*. Ecological significance of VAM spores in distribution among these tree species has been discussed.

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PIV-12 SEASONAL FLUCTUATION OF VAM IN TWO VARIETIES OF *RICINUS COMMUNIS* L.

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Vesicular arbuscular mycorrizal fungi are of immense importance to hydrocarbon bearing plants. They are also called petroplants. The day may come that the man depends on these plants for biofuels. Two varieties of castor *Ricinus communis* L. (Rosa & Mysore local) species and their mycorrhizal association have been screened in Dharwad district in different soils. Percent of colonization and spore number was determined. Spore number and colonization do not correlated with each other. However, there was no better appressoria formation. In most cases, penetration was direct by rupturing the outer cell wall and the hyphae developed inter and intracellularly in cortical cells. Arbuscule formation was observed on the second to fifth day penetration. In case of Mysore local spore number significantly increased during the month of August but least in the month of May. Where as in Rosa variety significant increased spore number was seen in the month of September and least number was recorded during the month of November. The results have been discussed with ecological implications on these two hydrocarbon bearing plants.

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PIV-13 INTERACTION BETWEEN VAM AZOTOBACTER AND PHOSPATE SOLUBILIZING MICRORGANISM ON JATROPHA CURCAS L.

(BIODISEL PLANT)

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Any countries economy depending on the production of biodiesel. Jatropha is a biodiesel plant. Man may depend on biodiesel plants in future. AM fungal associations have been screened in four different coastal and noncoastal soil chemical has been determined. Percent of colonization and spore number were not correlated with each other. However there was profusely branched well developed mycorrhizal colonization have been recorded. 25 saline tolerant VAM spores have been isolated from this study.

Green house pot experiments were conducted by using 1:1 ratio of coastal sand and forest soil. Interaction studies with Azotobacter and phosphate solublising microorganism revealed improved plant growth and biomass production. Mycorrhizae or Azotobacter inoculated plants demonstrated favorable plant growth and chlorophyll "a" content however optimum plant growth response, Biomass production, Percent of colonization, spore number and "P" content was significantly recorded in plants received all the bioinoculants such as VAM, VAM+AZ, VAM+PSB and VAM+AZ+PSB. In general it can be conclude that results of the study that saline tolerant VAM and Azotobacter with PSB has significantly improved the growth and development of *Jatropha curcas* seedlings.

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PIV-14 LEAF LITTER DECOMPOSITION IN A SEMI-ARID ECOSYSTEM AT MADURAI, INDIA. NUTRIENT RELEASE AND WEIGHT LOSS IN RELATION TO THE CHEMICAL COMPOSITION, SOIL PROPERTIES AND CLIMATE

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A comparative study of litter decomposition in semi-arid ecosystem, at Madurai using litterbags revealed that grass *Cymbopogon citratus* Stapf leaf litter reduced by 99% in one year, whereas the legumes *Leucaena leucocephala* (Lam.) de Wit reduced by 77% and *Albizia lebbeck* (L.) Benth. Leaf litter reduced by 59%. There was a significant difference in foliage litter chemistry (% C, N, P, K, Na, Mg, Mn, Zn) among species. No difference between *Albizia lebbeck* and *Cymbopogon citratus* was noted in concentrations of Cu and Pb. Linear decay function and exponential decay function provided satisfactory fits to all litter data. Different mineral elements from litter over the time intervals are compared. Simple linear regressions were performed between leaf mass remaining and several litter quality parameters.

Concentrations of N and P decreased with decomposition in *Leucaena Leucocephala* and *Cymbopogon citrates* litters. Concentrations of C, Na, and Mn decreased with decomposition in all species. Variation in leaf litter disappearance to environmental and soil variables indicated that mean relative humidity etc. A linear combination of cumulative rainfall, mean monthly average of high and low relative humidity explained 83 to 94 per cent and a combination of soil temperature and moisture explained 25 to 46 per cent of the variability in monthly weight loss.

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PIV-15 A PRELIMINARY SURVEY ON THE BASIDIOMYCETES DIVERSITY OF THANDIKUDI HILLS OF WESTERN GHATS

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Documenting and understanding the bio diversity at regional, national, global level is a renewed interest in the present time. Biodiversity is the term with multiple attributes and in the case of microbial diversity, morphological diversity, ecological diversity, physiological, biochemical and molecular aspects are significant. Every country has the responsibility to conserve, restore and sustainably use the biodiversity within its jurisdiction. India is recognized as one of the 12 mega biodiversity regions in the world. Though India is rich in biodiversity, the bioresources are under increasing pressure due to over exploitation, changing land use, soil, air, water pollution and green house effect syndrome.

The present study aims to explore the basidiomycetes fungal bio diversity in Thandigudi Hill of the Western ghats. Basidiomycetes fungal bio diversity in Thandikudi hill, Western ghat , is very rich due to the availability of fallen dead wood and debris which support the growth of several wood rotting ,litter decomposing and soil inhabiting basidiomycetes fungi .Majority of the genera collected between August and September 2005 were observed to belong to the wood rotting group. The commonly recorded genera were Polyporus, *Ganoderma, Mucidula, Pleurotus, Inocybe* and *Lycoperdon. Collybia, Mycena, Cortinarius were* found to be of rare occurrence. These species were confirmed with International fungal taxonomists and documented.

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PIV-16 MACROFUNGAL DIVERSITY AND CONSERVATION IN THE SURULI HILLS OF SOUTHERN WESTERN GHATS, TAMILNADU

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The variety and galaxy of fungi and their natural beauty occupy prime place in the biological world and India has been the cradle for such fungi (Manoharachary *etal*, 2005). Only a fraction of total fungal wealth has been subjected to scientific scrutiny and mycologists have to unravel the unexplored and hidden wealth. Macrofungi are a diverse, commonly encountered and ecologically important group of organisms. Like most fungi, the major part of these organisms consists of a mass of thin; microscopic threads (termed mycelium) growing in soil, decomposing leaves and other substrate. Macrofungi are vitally significant in forests; many species help break down organic materials such as dead tree trunks and leaves, into simple compounds usable by growing plants. Thus, they act as nature's recycles, without which forests could not function (Muller, 2005)

The Suruli Falls which falls from a height of 150 feet gathers into a pool, flows for a short distance and again plummets to a depth of 40 feet, offering a spectacular sight of nature's raw and wild beauty. The dense forests that surround it provide an awesome backdrop. Facilities are available for men and women to bathe separately in This falls. The special feature of the fall is that it is "a round the year" fall. However, the best season to visit is June - October, when the thickness of the water column is astounding. The beauty of this fall finds mention in Tamil Epic, Silappathikaram written by poet Ilango. The presence of the waterfalls and the average rainfall in the study area favours the macrofungal growth. The main objectives of the study was

To record rich biodiversity of macrofungus growing in the Suruli hills and, to suggest some conservation measures for the preservation and protection of macrofungus growing in this area. The results of the present study will be discussed in the session.

Conservation measures

Threats to macrofungi throughout the globe are of concern since they are not only beautiful but also play a significant role in human welfare.

- Conservation of habitats
- *In situ* conservation of non-mycological reserves/ecological niches
- Developing strategies for *ex situ* conservation of macrofungus on long term basis
- Documentation of macrofungus should be encouraged. In this regard well-planned and coordinated efforts at individual level, voluntary organizations level, NGO's and various local agencies level should be made.

- Checklists of macrofungi should be made available in all the country throughout the world.
- Legal protection and freedom from human interference to maintain the natural habitats should be given.
- In the absence of legal protection, some efforts needed to be made to have code of practice or suggestive documents stressing the importance of macrofungal conservation.

PIV-17 AEROBIC GRAM NEGATIVE BACTERIAL DIVERSITY IN THE GUNDARU BASIN

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The Gundaru River originates from Varshanad Hills of the Western Ghats. The objective of the present study is to analyse the bacterial community in Gundaru river soil from Nov. 2002 to May.2004. Soil samples were collected every month, normally at 15cm depth of the soil bed and then transferred into a clean, sterile container and streaked on bacteriological medium nutrient agar and selective SS agar medium and EMB agar and BSA agar etc. By prospective analysis, most probably, aerobic, gram negative bacteria were identified according to the procedure proposed by Von Graevenitz and Funke (25). By means of conventional methods of reactions including the catalase test, acid producer and utilize glucose, mannitol, sucrose and nitrate reducing, hydrolysis of urea and its motility is confirmed.

The collections of strains were studied for a period of Nov 2002 to May 2004

i) In soil samples, 30 strains of Gram negative rods were well identified by phenotypic test.

ii) From Sewage samples also 30 strains of Gram negative organisms were isolated.

By Standard Microbiological investigations, *Salmonella* and *E. coli* presence were confirmed. *Salmonella* and *E. coli* population was more in winter season than in summer, when compared to other soil and water microbes. *E. coli* and *Salmonella* always present in Gundaru Basin which may cause serious endemic disease which correlated in the Government Hospital Data. Tirumangalam.

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PIV-18 A STUDY OF FUNGAL BIODIVERSITY IN MEGAMALAI FOREST, WESTERN GHATS, TAMIL NADU

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Megamalai forest of Western Ghats of Tamilnadu will be used for the present study. A total of 29.281 Ha falls under dense forest areas, of which only 2,243 Ha was tree bearing. The Western Ghats in Tamilnadu comprise of 5,596 Square Kilometers of forests, out of the total forest area of 22,870 Square Kilometers. Megamalai forest is situated near Suruli Falls in Cumbum Valley. It is about 6500 Ft above from Sea level. The Megamalai forest has low temperature and often called as the "cloud land division". There are 3 Dams constructed in the above area namely Megamalai Dam, Manalar Dam and Iravangalar Dam. The main source of water in this Dam is collected from hills area. Megamalai forest consists of Kadana Estate, Megamalai, Manalar, Venniyar, Maharaja Mettu and Iravangalar. In this forest a varieties of trees are there namely *Eucalyptus globolus, Tectona grandis, Calamus rotang, Syzygium Cumini, Terminalia Chebula* etc.

The objective of the present study is to understand the richness and diversity of Fungal Population (Fungi and Actinomycetes) in the Megamalai forest ecosystem. The seasonal distribution of fungal species in soil samples of Megamalai forest, situated in Western Ghats of Tamilnadu. Two different sampling sites were selected for fungal diversity studies. The diversity of fungi was carried out by enumerating the samples on potato dextrose Agar medium and the enumerated distinct colonies were identified under the microscope by means of lactophenol cotton blue staining technique. Analysis of results showed that maximum number of strains belongs to the genus *Trichoderma* followed by *Verticillium, Beauveria* and *Paecilomyces* respectively in decreasing order significant population variation was also monitored at pre monsoon and post monsoon seasons. Maximum number of colonies was found in post monsoon seasons.

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PIV-19 AGARIC FLORA OF SOUTH INDIAN FORESTS

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Plant species richness is related to ectomycorrhizal species richness and nutrients from trees that are well exposed to sunlight transported to trees under shades through hyphae of mycorrhizal fungi, now known as wood wide web (www) (Johnson *et al.,* 2005). Tamilnadu and Andhra Pradesh are richest floristic area in the world. Both Western and Eastern Ghats of India run through these states are the basis for the varied diversity. Hence many surveys were undertaken to study the mushroom flora of these hot spots of biodiversity. The Eastern Ghats are located between $11^0\ 30^1$ and 22^0 N latitude and $76^0\ 50^1$ and $86^0\ 30^1$ E longitude and spread over three states of India, namely Orissa, Andhra Pradesh and Tamilnadu. Agaric diversity of several hill stations of Tamilnadu and Andhra Pradesh like Kodaikanal, Ooty, kolli, Keeripari and Tirumala have been investigated in recent years.

Our intensive study on the Agaric wealth in this area for 5 years from 2002 - 2006 enabled us to record 300 species belonging to 41 genera in 15 families. This enumeration also includes 14 ectomycorrhizal species. The basidiomycetous wood rot, litter decomposers and the soil inhabitants help in enriching the soil by mineralizing the biomass and recycling the nutrients which in turn helps in maintaining biodiversity.

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V. CONSERVATION AND MANAGEMENT OF FOREST BIODIVERSITY RESOURCES

PV-01 DIVERSITY AND CONSERVATION OF GENUS *CARALLUMA* (ASCLEPIADACEAE) IN PENINSULAR INDIA

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In Peninsular India, there are about 60 endemic genera, of which 49 are monotypic. The endemic generic category of Peninsular India is a diverse assemblage of herbs, succulent scapigerous herbs, shrubs, climbers and trees. *Caralluma,* belonging to the family Asclepiadaceae, is a genus of xerophytic succulent herbs. Out of 13 species reported from India, 11 species occur in Peninsular India, of these 5 species and 5 varieties are endemic to Peninsular India. The Indian *Caralluma* presents great difficulties in

identification from the Herbarium specimens as certain important characters are not discernible, but easily recognizable in fresh materials. The key characters used for identification of *Caralluma* are acuteness and roundness of stem, distribution of hairs on the petals, ground colour and purple streaks on the petals. These characters can be made out only in live specimens. The recent evolutionary forces and hybridization potential of the species resulted in intermediate and new forms among these groups. Many presumed hybrid varieties have been reported among the *Caralluma adscendens* and *Caralluma stalagmigfera*, and varieties have not been named so far. Many Peninsular Indian *Caralluma* species are not collected after the type collection; for example *Caralluma bhupiderana, Caralluma procumbens* and *Caralluma sarkariae*. A few species like *Caralluma pauciflora* and *Caralluma truncato-cronata* are enlisted under the endangered category. The present paper deals with taxonomic account of genus *Caralluma* and their conservation status in Peninsular India.

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PV-02 *IN VITRO* PLANTLETS FORMATION THROUGH COTYLEDONARY NODE AND EPICOTYL EXPLANTS IN *WRIGHTIA TINCTORIA* ROXB

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Wrightia tinctoria is a tree species of the family Apocynaceae and is indigenous to tropical countries like India. Traditionally, this plant finds use in a number of diseases and is commonly used as anodyne and hypertensive carminative. The digestive plant parts of bark and seeds are useful in vitiated conditions of pitta and kapha, dyspepsia, flatulence, colic, diarrhoea, leprosy, psoriasis, haemorrhoids, dipsia, helminthiasis, fever, burning sensation and dropsy. In the present study, the experiments were designed to compare the different concentrations of BA (benzyladenine), KIN (kinetin), and IAA (indole acetic acid) alone and in combination to assess their effect on shoot bud regeneration. In the first phase, cotyledonary node and epicotyl explants were cultured on the MS medium supplemented with different concentrations (1 μM, 2 μM and 3 μM) of BA and KIN separately. In the second phase, explants were cultured on the MS medium supplemented with BA (1 μM) and KIN at various concentrations (1, 2 and 3 μM). The explants were also cultured on MS medium supplemented with BA (1 μM) + KIN (1 μM) + IAA (2 μM). All cultures were maintained under 8 h dark and 16 h white fluorescent light of 70 $\mu Em^{-2} S^{-1}$ at a temperature of 25 ± 2°C with 60% relative humidity.

The cotyledonary node explants of *Wrightia tinctoria* placed on MS supplemented with BA exhibited both callusing and shoot bud formation in more than 70% of cultures. MS + BA at 2 μM had

90% shoot regeneration and the length of shoot was greater than in MS. The epicotyl explants placed on MS medium with BA recorded regeneration response within 8 days in about 90-100% cultures. The explants exhibited both callusing and shoot bud induction similar to cotyledonary node explants. These explants had better regeneration frequency and increase in shoot length against cotyledonary node explants placed on MS medium with different concentrations of BA. Both cotyledonary node explants and epicotyl explants of *Wrightia tinctoria* implanted on MS medium with BA and KIN recorded regeneration responses after 10 days of incubation in 70-80% of the cultures. In both the cases about 40-60% of the cultures had shoot induction along with callusing but there was no multiple shoot. The length of shoots regenerated from epicotyl explants was greater than that of cotyledonary node explants. Further, MS medium supplemented with BA + KIN + IAA promoted regeneration of cotyledonary node and epicotyl explants after 7 days in about 90% of cultures. Both the explants showed callusing and shooting. The length of shoot was greater while placing epicotyl explants on MS + BA + KIN + IAA (4.5 ± 0.7) than all the other combination of hormones used. Multiple shooting was noticed from the cotyledonary node explants placed on the MS supplemented with BA (1 μM) + KIN (1 μM) + IAA (2 μM) The explants used in our studies developed rooting in the MS medium containing cytokinins and IAA at 2 μM but it was not true when such explants were placed on MS with BA and KIN separately and in combination. The explants exhibited callus formation whith shoot bud differentiation. It is evident that the addition of IAA with cytokinins (BA and KIN) in MS medium had appreciable synergistic effect in terms of shooting, rooting and initiation of callus development. Moreover, The types of explants and hormones might play a role in multiple shooting besides the concentrations of hormones.

It may be concluded that the cotyledonary node and epicotyl explants of *Wrightia tinctoria* exhibited both callusing and shoot bud formation in MS + BA and in MS + BA + KIN, but the regeneration frequency and the length of shoots were different. Both shooting and rooting along with callus formation was noticed while placing the juvenile explants on MS + BA + KIN + IAA. It was interesting to note that the cotyledonary node explants alone had multiple shooting with callus. MS with BA or KIN at the concentrations of 2 μM and 3 μM appeared to be optimum for induction of morphogenic responses of selected explants of *Wrightia tinctoria*. However, successful induction of rooting along with shooting could be achieved only in MS with cytokinins and IAA. The study evidences that *in vitro* regeneration of *Wrightia tinctoria* is possible by selection of suitable explant and concentration and combination of phytohormones to meet the objective of rapid propagation and conservation of the socially relavent plants for sustainable utilization in traditional medicines

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PV-03 A SIMPLE AND WOODEN FRAMED LOW COST GREENHOUSE FOR RAISING VIGOROUS AND HEALTHIER TREE SEEDLINGS

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There is a need to produce healthier saplings of tree species for the purpose of afforestation to bring land cover to 33 per cent geographical area for keeping environment sustainable. Saplings production in the open field is mainly affected by harsh climatic condition. It also takes a long period to maintain saplings under nursery to get optimum seedling growth rate. Control over the prevailing environmental condition for increasing saplings growth rate is an important alternative strategy. Low cost greenhouse is one such technology to raise saplings under partial or fully controlled condition. In this paper, details are given for the design, basic requirements and the construction details of low cost greenhouse. This can be used for the production of high quality healthier saplings of tree species throughout the year because of partial or fully controlled climatic condition that is being created. The cost of the greenhouse is Rs. 1500 for a unit size of 5 x 3m (15m^2). The required materials are UV stabilized film (45 m^2), 7 cm diameter wooden poles (23 nos), 5 cm diameter wooden poles (17 nos), nails (0.5 kg) and coal tar for anti-termite treatment (1 litre).

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PV-04 PLANTLET REGENERATION FROM SYNTHETIC SEEDS OF *COELOGYNE STRICTA* AN ENDEMIC ORCHID

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Propagation of *Coelogyne stricta* (D.Don) Schltr. by encapsulating protocorms in sodium alginate as a measure of conservation is described. Freshly collected undehised seeds of *C. stricta* were directly germinated on MS medium lacking plant growth adjuncts for the development of protocorms. The well developed protocorms were encapsulated with distilled water with 3% sodium alginate and germinated on different organic additives like Activated charcoal (AC), Caesin Hydrolysate (CH), Yeast Extract (YE) and Coconut water (CW). YE at 200 mg/l proved to be effective in bead-to plant conversion with 84% of germination. Average seedling length and root number was also favorable in the above combinations. CW proved to be effective for the development of multiple shoots. The well developed plantlets were hardened successfully.

PV-05 DISTRIBUTION OF *AMENTOTAXUS ASSAMICA* FERGUSON IN ARUNACHAL PRADESH AND ITS CONSERVATION STRATEGIES

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Amentotaxus assamica Ferguson is critically endangered and endemic species to the state with very limited population in small pockets. The species was reported to occur only in the Dalai valley in Anjaw district of Arunachal Pradesh. The species is recently recorded from several other locations in the state with very limited populations. Recently, a new undisturbed patch of the species has been reported from Papumpare district of Arunachal Pradesh. Shifting cultivation and excessive tree felling in the region are the major factors for the depletion of its population that may pose threat for the existence of the species. Further, the local people of the region are ignoring about the importance of the species and hence no conservation step has been taken so far. Therefore, extensive exploration and detailed study of the population structure of the species in need in order to formulate suitable measures for conservation before the species goes into the verge of extinction. The present paper highlights on the proper distribution of the species throughout the state as well as the probable areas of its occurrence in the state for further explorations. The paper also focuses on the conservation and management of the remnant population through government initiatives and local people participation.

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PV-06 STUDY OF SACRED GROVES OF SIRUMALAI HILLS DINDIGUL DISTRICT, TAMILNADU.

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Sacred groves are undisturbed vegetational areas maintained by local communities for their belief, cultural and magico-religious faith. Within these groves are locked ancient secret of herbs and traditional folklore. This paper examines the flora of sacred groves of Sirumalai hills. About 10 sacred forest groves have been surveyed and there is estimated around 80 plant species, which are well protected under the belief and faith of local people. These sacred groves are very significant in this area and are variously named as 'Oorcholai' 'Pothucholai' and 'Koil'. Some medicinally important species like *Crataeva religiosa, Catharanthus roseus, Phyllanthus emplica, Wrightia tinctoria* and extinct species such as *Angiopteris evecta, Gnetus ula, Uvaria narum* are recorded in these areas.

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PV-07 SACRED GROVES (OR) KOVILKADUGAL OF CUMBUM VALLEY IN THENI DISTRICT OF TAMILNADU – INDIA

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Cumbum valley is situated in the western ghats of Tamilnadu which is very nearer to Thekkady a famous tourism centre in Kerala. Cumbum valley is fertile with cereals of Paddy, Ragi, Cumbu, Thinai, Samai and Pulses of Beans, Black gram, Bengal gram. 'Sacred groves' and 'Sacred trees' are age old traditions involving the people participation in conserving the ecosystem. The local People described it as 'Kovilkadugal'. These groves are the last remnants of the forests that once thrived in these areas. In the shade of the trees there is to be found shrine, generally of the mother goddess.

In the present study, attempts have been made to analyse the ethnobotaincal and ethnomedicinal significance. Socio - Cultural significance of such sacred groves confined to various temples in Cumbum valley. The important sacred groves being in "Bhagavathi Amman Kovil" at Lower camp, "Ayyanar Kovil" at Seelayampatti. Majority of the sacred groves are having Neem, Vilvam, Vagai, Panai, Kadambu, Kondrai and Arasu. The grasses which are found in Kovilkadugal are Nanal, Arugampullu and Kuppaimeni, Nayuruvi are the herbs presents there.

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PV-08 TWIN SEEDLINGS IN *HOPEA UTILIS* (BEDD.) BOLE

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The twin seedlings in *Hopea utilis* were observed during the germination period of September 2005 under green house conditions. Only 2-4 percentages of twin seedlings were noted. In the sand medium out of hundred seeds tested, four seeds were produced with twin seedlings within 5-6 weeks interval. Then the seedlings were transplanted into poly cups containing sand: soil: farmyard manure 1:2:1 ratio and maintained in green house as well as laboratory conditions for further studies.

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PV-09 BIO-DIVERSITY RESOURCES : CONSERVATION & MANAGEMENT IN THE TRADITIONAL CULTURE; A CASE STUDY OF BOLANGIR (ORISSA)

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Study on plant resources linked with cultural aspects in Bolangir reveals 253 plant species belonging to 72 diversified families. Cultural functions are purposeful for healthy and wealthy life. Use of different plant parts in culture are meaningfully designed as custom and believe for resource management and conservation. Formulation of nested institutions in accordance with social customs to protect the endemic culture, tradition and sentiment will help in ecosystem management and conservation in form of Village Bio-reserves as Sacred grooves. Such nested institutions for herbal practitioners will help in bio resources maintenance and timely treatment with nascent herbs. Conservation of endangered species can be effective through popularizing their use in the society.

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PV-10 MICROPROPAGATION AND IN VITRO CONSERVATION OF *ECLIPTA ALBA*

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Amongst roadside herbs, *Eclipta alba* occupies a significant place in herbal pharmacy because of its important medicinal properties. It grows as a weed in moist, shady places especially by the side of bushes, rice fields, and drains. This plant has long been used traditionally for nourishment of hair. Besides, it is well recognized in treatment of various hepatic disorders and used widely in ayurvedic medicines and dietary supplements in non-conventional medication system. The plant recently gained importance after being used in therapeutic research. Though it grows widely in nature, but indiscriminate collection over years from its natural habitat may pose a serious threat to the survival of the plants' population.

As field conservation of this important but common weed is not known yet, present study emphasizes conservation of this medicinal herb under tissue culture environment. Initially an efficient micropropagation protocol has been standardized in order to establish a source of sterile plants required for in vitro conservation study. In this regard culture was established with shoot tip explants in MS in presence of BAP 1.0 mg/l for multiplication of shoots (6 shoots / explant on average) and IAA 1.0 mg/

l for rooting of shoots. In conserving shoot tips (in vitro germplasm) from micropropagated plants following slow growth technique, mannitol was added in culture medium. 4% mannitol was found to be most effective for mid-term storage of *E.alba* germplasm in respect to retarding culture growth and increasing post storage survival frequency. Germplasm in the form of gelatin beads made by encapsulating shoot tip fragments with 3% calcium alginate were found storable for short-term period. Maximum viability of encapsulated germplasm (100%) with re-growth potential were noticed when storage period was 2 months or less than that and maintained under light at 4ºC. Conditions like darkness, temperature below 4ºC and extension of storage period beyond 2 months affected viability of germplasms. After resuming growth, in vitro-conserved plantlets when transferred to natural climate survived in vivo successfully.

Present attempt of conserving *E.alba* in vitro, opens up scope of developing an alternative source of this important germplasm without any hazard, as often met in natural condition.

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PV-11 WILD EDIBLE PLANTS AND THEIR NUTRITIONAL POTENTIAL: A CASE STUDY FROM THE NORTHERN WESTERN GHATS OF INDIA

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Wild edible plants have long been used as a source of subsistence mainly by rural people. Many of them possess good nutritional properties, which need to be addressed from the context of food security. Present paper documents diversity and nutritional qualities of wild edible plants at Shilimb (18°36' N Lat and 73°22' E Long) and explores traditional knowledge associated with such species. Fortnightly visits were made to the study area with the help of local knowledgeable individuals. Information about:- a) season b) edible plant part c) when to collect d) how to collect e) how to store etc. is collected through semi-structured interviews with villagers. So far we have recorded 31 species out of which 30 % have folk medicinal value. These plants were subjected to nutritional analysis comprising of total proteins and total carbohydrates. For example *Vigna vexillata* has 3.87 gm % and 2.2 gm% of total proteins and total carbohydrates, whereas *Smilax zeylanica* has 4.34 gm% and 2.2 gm% of total proteins and total carbohydrates respectively. As a follow up process such wild edible plants can be further taken up for pilot scale plantation through self-help groups and rural kitchen herbal garden programmes.

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PV-12 BIODIVERSITY AND CONSERVATION OF PICHAVARAM MANGROVES

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The extensive clearing of mangroves at Pichavaram over the last 50 years has caused many areas to vanish and they are now become degraded sites with secondary vegetation or rehabilitated areas with modified species and community characteristics. The present paper deals with the concept and goals of mangrove ecosystem rehabilitation and contrasted with ideas of ecosystem restoration.

Pichavaram mangrove forest (Lat. 11° 21′ N; Long. 79° 50′ E) is present in the higher land of Vellar-Coleroon estuarine complex. The mangrove forest extends to an area of 1,100 hectares, representing a heterogeneous mixture of mangrove species. The source of freshwater to this mangrove is form both the estuaries and that of seawater is Bay of Bengal. The mangrove area comprises about 51 small and large Islands with their sizes ranging from 10 m^2 to 2 km^2. About 40% of the total area is covered by water ways, 50% by forest and the rest by mud flats, sandy and salty soils. Pichavaram mangrove forest forms a great wealth of biological diversity in mangrove and halophytic ecosystem with 14 species of mangroves and 11 associate species.

Indian remote sensing data showed that the total area of the mangroves decreased to large extent. The values shown by satellite data also shows a decrease in the mangrove area, which may be due to several reasons such as, grazing by domestic cattles and exploitation of mangrove woods for fuel and timber, rapid trend of reclamation of mangrove forests for habitations and pollutant discharges from cities and industries etc. To facilitate the management and conservation of Pichavaram mangroves several measures can be taken.

1. To prevent non-reserve mangroves from further deteriorating is to declare as nature reserves.
2. The causative factors responsible for endangered species from mangrove forest has to be studied.
3. More nurseries are to be developed globally to provide continuous supply of planting materials especially for the endangered species.
4. Economically important mangrove species are to be selected for large scale plantation.
5. Management guidelines have to be implemented for mangrove development polices and such guidelines should also consider an ecological, economical and social problem of the local inhabitants.

At present Dr. M.S. Swaminathan Research Foundation at Chennai, Tamilnadu State Forest Department and Annamalai University are involved in rehabilitation of mangrove vegetation at Pichavaram.

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PV-13 HUMAN CULTURAL DIMENSION ON FOREST DIVERSITY CONSERVATION

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Scientific advancement and industrial development lead human population growth is the main cause of enlarged alarming threatened list consist of 81 species of mammals, 47 of birds, 15 of reptiles and three of amphibians and a large numbers of butterflies and moths in India. The largest threat to the biodiversity is from the lack of appreciation of the difference in the knowledge systems. The entire trend is to look at knowledge in terms of a mono-science as the only way to explain nature where as the past management system including policing activity reveals the importance of participatory forest management system.

Worshiping nature and various living beings has been practiced in India, from time immemorial. This led to Conversation of nature, plants and animals to some extent. Sacred groves are one of the traditional, informal conversation concepts for preserving bio, socio-cultural diversity. The relationship between man and trees is based on religion. This human belief on God is the main backbone for this method of forest conservation. Infact, the practice of dedicating groves to local deities has a long history, these groves are the ancient natural sanctuaries where all forms of living creatures are given protection by a deity. No one is permitted to cut any tree or plant, kill animals and birds, or their surroundings. The cultural integration is also possible by the conversation methods of these groves. Mostly these Sarpakavu / Kavu / Koilkadugal reserves most the ecologically important species by undisturbed environment. In micro level the concept of sacredness was intrude to man by linking their stars with trees (or) temple with trees as "Sthalavirksha" (or) star forest trees. In this article the various human cultural dimensions towards conservation of biodiversity is well discussed.

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PV-14 FOREST DISTURBANCES AND CONSERVATION MANAGEMENT IN THE CUMBUM VALLEY OF TAMIL NADU

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Forests are rich in biodiversity and biological resources with both tangible and non-tangeable benefits. Forest products and benefits of plant and animal origin one being over utilized and manipulated for a very long period. Due to this, many of the sources of forest products namely plants and animal

species are ether extinct or are getting rare or endangered. Leaving a few species extinctions in the evolutionary process, which s expected and inevitable, rest are all the outcome of direct exploitation, manipulation or habitat distortion by the humans. The loss of biodiversity of natural forests is mainly due to exploitation of its component species or due to habitat destruction. Of course, out break of diseases or pests, natural calamities and inherent defective traits n breeding and regenerating mechanisms of species also contribute to species extinction in nature, ether singly or in groups. However, this being not directly linked with the utilization potential of the species, such losses are not man-induced. On the other hand, if species loss due to such uncontrollable factors is compared with that resulting from exploitation or habitat degradation, it is quite evident that drain n biodiversity and species per se is mostly man induced.

The Cumbum valley lies between the Western Ghats and Gandamanickanur hills. Considerable portions of the valley are occupied by hills consists mainly of (a) the gandamanaickanur-Saptur and Andipatti hills (b) the eastern slopes of the Western Ghats. The climate is hot and dry, the temperature ranging from 15.6 to 42.2^{0}C. The hottest period of the valley is from April to June and the heat in the Cumbum valley is reduced during the Southwest monsoon. The average rainfall of the valley is 800-900mm. The soil of the valley is generally deep sandy loam of reddish type. Suruliyar Hydro electric project is situated in this valley and periyar hydroelectric project is situated at the foothills of the valley.

The disturbance due to humans can alter the structure and composition of forest ecosystem. It also affects the nutrient cycling and the relative fragility of forests. Fire also affects the species composition of the forest. Except those fires caused by lightning or volcanic activity, which are rare and confined only to certain specific areas, most of the fires very common inmost of the regions are of biological origin. These are mostly man-caused and sometimes chiefly in forests, develop due to mutual friction between tree (bamboos etc) surfaces. Apart from man made disturbances and fire, herbivorous animals kill the plants and use unharvested herbs, shrubs or even trees as their food and sometimes pose much problems of management of natural and artificial vegetations. Grazing and browsing may bring about marked changes in vegetation.

Conservation measures

- Reduce pilgrims and tourists pressure
- Evolve location specific strategies for preventing negative impacts on biodiversity by the pilgrims and tourists.
- Prevent grazing in protected areas
- Create sustainable livelihood options for forest dependent graziers by adopting micro credit and micro financing.
- Promote stall fed milch cattle by arranging loans
- Create fodder resources outside the forest areas
- Promote agroforestry and silvipasture for meeting fodder needs.

- Evolve fire management plan for each forest division involving fire line clearance, engaging fire watcher and by controlling fire
- Provide cell phone and modern gadgets for communication and for fire control

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PV-15 BIODIVERSITY HOTSPOTS: A GLOBAL PRIORITIZATION SYSTEM FOR CONSERVATION OF BIOLOGICAL RESOURCES

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Life on Earth faces a crisis of historical and planetary proportions. Unsustainable consumption in many northern countries and crushing poverty in the tropics are destroying wild nature. Biodiversity is besieged. Extinction is the gravest aspect of the biodiversity crisis: it is irreversible. The biodiversity hotspots hold especially high numbers of endemic species, yet their combined area of remaining habitat covers only 2.3 percent of the Earth's land surface. Each hotspot faces extreme threats and has already lost at least 70 percent of its original natural vegetation. Over 50 percent of the world's plant species and 42 percent of all terrestrial vertebrate species are endemic to the 34 biodiversity hotspots. Our ultimate goal is to keep nature intact, which means that we must stop anthropogenic species extinctions. To approach this goal, we must slow the rate of species extinction as much as possible with whatever conservation resources we have at our disposal, which requires incorporating threats (or "vulnerability") and costs into priority setting. To qualify as a hotspot, a region must meet two strict criteria: it must contain at least 1,500 species of vascular plants (> 0.5 percent of the world's total) as endemics, and it has to have lost at least 70 percent of its original habitat. There are two major ways in which hotspots can change over time. The first is a real effect. Threats and their impacts change, meaning that some places may become more threatened while others may recover. The second is that our knowledge of biodiversity, threats, and costs is continually improving. Over the last few years these data have become better compiled. The map of Ecoregions developed by the World Wildlife Fund-U.S. is now the most widely used system for such bioregional classification. In total, this updated analysis reveals the existence of 34 biodiversity hotspots, each holding at least 1,500 endemic plant species, and having lost at least 70 percent of its original habitat extent. Overall, the 34 hotspots once covered 15.7 percent of the Earth's land surface. In all, 86 percent of the hotspots' habitat has already been destroyed, such that the intact remnants of the hotspots now cover only 2.3 percent of the Earth's land surface. Habitat destruction is a pervasive threat affecting hotspots and is already causing extinctions in many areas. Accelerating anthropogenic climate change will undoubtedly magnify the effects of habitat destruction and fragmentation. The most direct measure of this threat can be derived from assessments of conservation status of species. The

IUCN Red List of Threatened Species, compiled by the Species Survival Commission of IUCN-The World Conservation Union, classifies species that have a high probability of extinction in the medium-term future as Critically Endangered, Endangered, or Vulnerable. As a global prioritization system, hotspots are extremely important in informing the flow of conservation resources. However, they do not provide guidance as to how conservation should be focused on the ground. Conservation success depends on working effectively with people. Many residents of the Earth's most biodiverse places are extremely poor, living on less than a dollar a day. In addition, a large portion of the sites with remaining biodiversity is made up of traditional lands of indigenous peoples. Living resources have a unique place in indigenous cultures, and are also singular from a biological conservation perspective. Therefore, species loss represents not only a loss of global biodiversity, but of cultural heritage as well. In short, many people and many species share a common vulnerability and struggle for survival. While conservation in the hotspots is complex, expensive, and difficult, it is not optional. We utterly reject a triage approach of abandoning the hotspots to focus on less biodiverse, less threatened areas, where conservation is comparatively easier. Instead, we see the successes of the last fifteen years as a rallying cry for a tenfold increase in conservation attention. Nothing less than the diversity of life on Earth hangs in the balance.

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PV-16 SOCIO-CULTURAL AND ECOLOGICAL SERVICES OF JOGIMATTI SACRED GROVES OF SCRUB FOREST, DT.CHITRADURGA, KARNATAKA.

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Sacred groves or Devara kaadugalu are the patches of natural vegetation of a place dedicated to local deities by the local community for the protection and conservation of biodiversity. Sacred groves continue to be of much importance in religion, culture and resource use systems in many parts of India. Sacred groves of Kamataka attracted the attention of ecologists. The systematic and scientific documentation was pioneered by Gadgil and Vartak and continued by others. Present investigation aims to study plant diversity and to document socio-cultural and religious practices of local Jogi community associated with the Jogimatti scrub forest, Chitradurga district, Kamataka. Geologically Jogimatti area is known worldwide for its pillow lava formations. The study area consist of following sacred groves which are dedicated to the different deities viz, Jogishwara, Kukkuvadeshwari, Adumallashwar and Chandravalli Sacred grove. About 76 species of higher plants were enlisted and their ecological, medicinal values, religious and cultural importance have been emphasized. Plant diversity protection and conservation practices followed by the local community and forest department are presented in the paper.

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VI. WILDLIFE / ANIMAL BIODIVERSITY

PVI-01 ORTHOPTERA FAUNA OF THE GIBBON WILD LIFE SANCTUARY, ASSAM: A STUDY ON BIODIVERSITY

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Surveys were conducted to study orthopteran species diversity over a period of two years in Gibbon Wildlife Sanctuary (GWS), Assam. A total of 25 species of Orthoptera were recorded in Gibbon Wildlife Sanctuary, of which *Conocephalus (Xiphidion) melaenus* (De Haan, 1842) was not reported previously from Assam. Shannon's (H^1) diversity index appears to have more value (2.17) indicating species to be more diverse. Simpson's diversity index, 'λ', gives low value (0.05), of course, since, the value of λ decreases with increasing diversity. Evenness index E5 gave high values (2.39) for the GWS, indicated the species are evenly distributed. It is also important that few species viz., *Sanaa imperialis* (White, 1846), *Tegra viridivitta* (Walker, 1870), *Phyllomimus assimilis* (Walker, 1869), *Pseudophyllus titan* White, 1846, and *Conocephalus posticus* (Walker, 1869) are endemic to Assam because of the ecological uniqueness of the region, of course, since, eastern sub Himalayas especially Assam part is one of the mega biodiversity hot spots of the world.

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PVI-02 DIVERSITY AND DOMINANCE OF MOSSES IN BHADRA WILDLIFE SANCTUARY- KARNATAKA

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Mosses are one of the dominant plant communities of BWLS in Karnataka. A total of 58 species of mosses were recorded from sixteen 50m X 10m transects in four macro habitat (vegetation) types. The macro habitats samples varied from dry deciduous forest through moist deciduous, semi-evergreen, evergreen forest (montane forest) with the elevation ranging from 650 meters to 1875 meters. The macro habitats as well as microhabitats (viz, rocks, soil and wood) were compared by the richness of the moss flora. Fifteen species are lignicolous and corticolous, ten species are terricolous and seven species are

saxicolous. The other twenty-six species occurred on more than two major types of substrates. Among these, *Neckera* sp, *Pogonatum* sp, *Meteoriopsis* sp., were dominant in the BWLS. The microhabitats, rather than the altitude, seem to govern the local patterns of abundance and richness of the moss communities. Species, genus and family level diversities like á and â- diversity, were significantly positively correlated with each other. While habitat transformation, deforestation and fires may adversely affect the moss communities. The traditional livestock grazing and collection of fuel wood and fodder have no serious impact on moss diversity.

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PVI-03 STUDIES ON THE BIOLOGY OF THE BAMBOO LEAF ROLLER, PYRAUSTA BAMBUCIVORA AT RAIPUR (CHATTISGARH)

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Lifecycle of ***Pyrausta bambucivora*** was studied in the laboratory condition, during 2003 & 2004. Laval length and larval period were recorded in the laboratory were 22.7 mm. and 18 days, respectively. Pupal length was recorded as 13mm. and pupal period was 10 days. Wing spawn, body length and longevity were also recorded as 24 mm, 16.2 mm and 10 days respectively. The fresh bamboo leaves were provided as food during the study.

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About National Biodiversity Authority

Biodiversity is a multi-disciplinary subject involving diverse activities and action. It encompasses the variety of all life on earth. With only 2.5 per cent of land area, India already accounts for 7.8 per cent of global recorded species. Over 46000 species of plants and 81,000 species of animals have been recorded in the country so far by the Botanical Survey of India, and the Zoological Survey of India, respectively. India is an acknowledged centre of crop diversity, and harbours many wild relatives and breeds of domesticated animals. India is also rich in traditional knowledge, both coded and informal. The stake holders in biological diversity include the Central government, State Governments, institutions of local self-governmental organizations, industry, etc. One of the major challenges before India lies in adopting an instrument, which helps realize the objectives of equitable sharing of benefits enshrined in the Convention of Biological Diversity.

India is a party to the Convention of Biological Diversity (1992). The Government of India established The National Biodiversity Authority (NBA) in 2003 in accordance with Biological Diversity Act 2002, with the following objectives:

i. To regulate access to biological resources, of the country with the purpose of securing equitable share in benefits arising out of the use of biological resources; and associated knowledge relating to biological resources

ii. To conserve and sustainably use biological diversity

iii. To respect and protect knowledge of local communities related to biodiversity

iv. To secure sharing of benefits with local people as conservers of biological resources and holders of knowledge and information relating to the use of biological resources

v. Conservation and development of areas of importance from the standpoint of biological diversity by declaring them as biological diversity heritage sites

vi. Protection and rehabilitation of threatened species and

vii. Involvement of institutions of state governments in the board scheme of the implementation of the Biological Diversity Act through constitution of committees.

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