



**JNTBGRI**  
**ANNUAL REPORT**  
**2023-2024**

# ANNUAL REPORT

**KSCSTE-JNTBGRI**

**2023-2024**



**KSCSTE-JNTBGRI**

**KERALA STATE COUNCIL FOR SCIENCE TECHNOLOGY AND  
ENVIRONMENT - JAWAHARLAL NEHRU TROPICAL BOTANIC GARDEN AND  
RESEARCH INSTITUTE**

**Karimancode P.O., Pacha-Palode, Thiruvananthapuram-695 562, Kerala, India**

**JNTBGRI ANNUAL REPORT**  
2023-2024

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Front Cover: *Meiogyne pannosa* (Dalzell) J. Sinclair

Photo by Dr. A. Nazarudeen

Back cover: JNTBGRI, Photo by C. Suseendran

## Table of Content

S. N.	Content	Page No.
1	Introduction	8
2	<b>Garden Management, Education, Information and Training Division</b>	8
3	Trainings and Extensions	11
4	Technology Deployment for Socio-economic Development	12
5	<b>Plant Genetic Resources Division</b>	12
6	Medicinal, Aromatic & Spice Plants Unit	12
7	Field Gene Bank and Conservatory of Andaman & Nicobar Plants	14
8	Bamboo Biology Unit	14
9	Orchid Biology/ Carnivorous Plant Unit	15
10	Tissue Culture Unit	15
11	<b>Biotechnology and Bioinformatics Division</b>	17
12	Conservation Biotechnology	17
13	Bioproduction	19
14	Molecular Biology	19
15	Bioinformatics Centre	22
16	Plant Tissue Culture Unit	23
17	Saraswathy Thangavelu Extension Centre (STEC)	24
18	Technology Transfer	24
19	Consultancy	25
20	<b>Conservation Biology Division</b>	25
21	Documentation of Flowering Plants of India	26
22	Seed Bank	26
23	Palynology Laboratory	26
24	<b>Division of Phytochemistry and Phytopharmacology</b>	37
25	Phytochemical-Nanotechnology	37
26	Prey Capture Mechanism in <i>Nepenthes</i>	38
27	Anti-Chikungunya Virus Principle of <i>Sauropus androgynus</i>	38
28	Essential Oil of <i>Elettaria cardamomum</i> , its Insecticidal Activity	39
29	Insecticidal Properties of <i>Clausena austroindica</i>	40
30	Visitor-predator Patterns and Chemical Preferences in <i>Melocanna baccifera</i>	41
31	Head Space Volatile Chemical Profiling of Plants at JNTBGRI	42
32	Development of Tropical Soil Scent	42
33	Phytochemical Profiling of Selected <i>Agaricus</i> Species	42
34	<b>Division of Plant Systematics and Evolutionary Science</b>	43
35	Establishment of Custard Apple Park	43
36	Inventory, Systematics and Conservation of <i>Ixora</i>	44
37	Documentation of Folk Uses of Plants used by the Kani tribes	45
38	Reverse The Red	46
39	Vegetational and Ecological Assessment of Lateritic Zones of Northern Kerala	48
40	Herbarium Management and Development	49
41	Conservatories	49
42	Red Data Book of Kerala Plants	50
43	Conserving RET Species/ KSBB Funded (Kudumbasree Project)	50

44	<b>Division of Ethnomedicine and Ethnopharmacology</b>	51
45	Systematic Documentation and Bioprospecting of Ethnomedicinally Important Medicinal Plants	53
46	<b>Division of Microbiology</b>	58
47	New Species Published	60
48	Major Infrastructure Facilities Created at JNTBGRI	60
49	Plants for Sale at JNTBGRI	63
50	Tissue Culture Plants for Sale	77
51	Library and Information Centre	77
52	JNTBGRI Publications for Sale	79
53	Exhibitions Conducted/ Participated	80
54	Major Research Projects Undertaken	85
55	Continuing Research	85
56	Important Programmes Initiated	86
57	Significant Innovations /Outstanding Achievements	88
58	Special News and Important Events	91
59	Consultancy	94
60	Hybrid Registered	94
61	New Projects	94
62	Ph.D. Awarded	95
63	Academic Programmes: Ph.D. Programmes Ongoing	95
64	Internship, Training and Dissertations	100
65	Special Events	107
66	World Bamboo Day 2023	107
67	World Environment Day 2023	107
68	Extension and Training: Workshops/ Internships Organized	108
69	Seminars/ Trainings/ Workshops attended	114
70	Interim and Final Technical Reports	117
71	NMPB, SERB and MoEF & CC Supported Projects	117
72	Research Publications	118
73	Journal Published	127
74	Books Published	127
75	Book Chapter	130
76	Seminar/ Symposia Papers	134
77	Talks and Keynote Address	143
78	Report Presentations	149
79	Visitor Lectures	150
80	Public Events/ Outreach Programmes	152
81	Demonstration Classes & Field Orientation Programmes	154
82	Consultation Programmes	157
83	Popular Articles	158
84	Patents Granted	160
85	VIP Visits	160
86	Awards/ Honours/ Recognitions	161
87	Media Reports/ News/ Broadcastings	166
88	Radio Talks	167
89	Video Programme	168
90	Project Reports and Presentations	168

91	Extra Assignments/ Meetings/ Talks Attended	169
92	Retirements	170
93	Plan Funded Research and Infrastructure Programmes	172
94	Externally Funded Programmes	174
95	Research Council	183
96	Management Committee	184
97	Staff List	184
98	Expenditure Statement	189
99	Balance Sheet	190



## Director's Desk

I am delighted to present the Annual Report of Jawaharlal Nehru Tropical Botanic Garden and Research Institute (JNTBGRI) for the year 2023-2024. JNTBGRI, formerly known as TBGRI, is an autonomous R&D organization established in 1979, and is now governed by the Kerala State Council for Science, Technology, and Environment (KSCSTE). The Institute, aligned with its mission and vision, has been functioning in the major thrust areas, *viz.*, establishment of *ex situ* conservatories and garden development, integrated taxonomy and conservation biology, sustainable utilization of tropical plant resources, and infrastructure development and capacity building. JNTBGRI, with over 50,000 accessions representing 4,800 species in its conservatories, is the largest repository of live plants in India. The Institute has so far reported over 800 new life forms of angiosperms, mushrooms, and fungi. JNTBGRI Herbarium holds 43,000 specimens of nearly 4,021 species. The Institute also has a vast database of traditional and ethno-medical information from the state of Kerala. Its conservatories, species-mushroom herbaria, and seed bank serve as valuable repositories for students, academicians, foresters, and policy makers interested in plant wealth. The lab-based sustainable utilization programmes have resulted in peer-reviewed publications, patents, Ph.D.'s, new bioactive molecules, essential oils, gene sequences, and herbal products. To date, the Institute has produced over 175 Ph.D.'s. This year, over 20,000 visitors, including students, researchers, nature enthusiasts, and tourists, explored the conservatories.

Programmes under various themes are being implemented while maintaining a balance between knowledge generation and translational research. This report highlights the research conducted with continued support from the State and Central Governments, public and private sectors, industries, and academia. Additionally, it covers achievements and accolades, research publications and IP generation, infrastructure development, and major activities and programmes. JNTBGRI received several honours and awards in research and development, technology transfer, and IP licensing. Notably, this year, the Institute was awarded KSCSTE's SHRESTA programme, recognized with the prestigious 2023 Global Genome Initiative for Gardens (GGI-Gardens) Award, won the KSCSTE Best Scientist Award, and, among other infrastructure upgrades, installed a new LC-MS. Among others, Prof. Carl-Henrik Heldin, Chairman of the Board of the Nobel Foundation, was a distinguished visitor. The Institute has conducted various skill development programmes, receiving an overwhelming response from the public and private sectors, academia, and industries. I thank the State and Central Governments, numerous collaborators, well-wishers, and the media, as well as all those who have contributed in transforming JNTBGRI into a vibrant organization. I look forward to this sustained support in the years to come.

Dr. B. Sabulal

## INTRODUCTION

Adopted with a series of principles for the comprehensive management and sustainable utilization of the tropical plant resources and their environment, Jawaharlal Nehru Tropical Botanic Garden and Research Institute becomes the foremost conservatory botanic garden and research institution established by the Government of Kerala which functions under the umbrella of the Kerala State Council for Science, Technology and Environment (KSCSTE). JNTBGRI functions as a premier autonomous R & D Centre of the Government of Kerala, established on 17 November 1979 with a determined mission of conserving the waning tropical plant resources of India. The Institute thus focusses on the conservational, taxonomic - phytochemical - phytopharmacological - ethnobotanical - biotechnological and economic aspects and sustainable utilization of India's tropical plant diversity. The Institute drives in the thrust areas *viz.*, Establishment of *ex-situ* conservatories and Garden development, Integrated taxonomy and Conservation Biology, Sustainable Utilization, Biotechnology and Bioinformatics coupled with capacity building and training which places environmental issues at the foremost concerns linked with the economic growth and well-being of the people around. The idea of establishing conservatory botanic garden and research institute was conceived after the first United Nations Conference on Human Environment, held in Stockholm in 1972, the first world conference to make the environment a major issue. It was under the committed efforts by late Professor A. Abraham, the Founder Director, the Garden became a reality. It was established as an autonomous R & D organization. The Kew Botanic Gardens played a significant role in the design and layout of the garden in its early phases.

## GARDEN MANAGEMENT, EDUCATION INFORMATION AND TRAINING DIVISION

The Garden Management Division is responsible for the *ex-situ* conservation of indigenous flora particularly endemics and IUCN Red-listed species and dissemination of botanical knowledge to the public. There are ten different themes/ function-based units in the division *viz.* (i) Aquatic plants conservatory, (ii) Arboretum, (iii) Palmetum, (iv) Ferns & Gymnosperms, (v) Fruit Plants including lesser exploited indigenous species, (vi) Ornamental plants & landscapes (vii) Central nursery, sales and distribution, (viii) Compost management (ix) Public relations, visitors' management and extension activities and (x) Labour management. The division also maintains the aesthetic landscapes focusing frontage and

major roads. The Central nursery unit develops propagation protocols for endemic species and multiply them for *ex-situ* conservation, sales/ distribution and for eco-restoration. The Visitors Management Centre unit of the Division is responsible with arranging guided tours for visitors and outreach programmes like exhibitions, consultancy in developing Bio-parks/ Eco gardens for schools and other government organizations. The division operates many external funded projects like Sacred grove restoration, Bio-parks in public places, Avenue planting *etc.* to restore the vanishing natural flora.

## **Research & Development**

- 1. Frontage garden re-landscaping:** The premises of the new Ficus model arch re-landscaping was the most important garden development work done during the period. About 1000 sq. feet road underneath of the arch is paved with interlock being provided with proper drainage. The old rose garden site is developed into a 4000 sq. feet carpet grass lawn with definite shaped plant beds construct of riverbed stones. A riverbed stone-step upward at the east side adds to the landscape attraction. Deep red flowered *Ixora*, *Coreopsis*, *Euphorbia* and other perennials were planted. About 2000 sq. feet courtyard front of commercial tissue culture lab was also turfed with carpet bed with a foliage bed of *Calathea* close to the porch.
- 2. Re-landscaping of riverbank near existing Central Nursery:** A leisure landscape exploiting the beautiful view of the curving Chittar River flow with waterfalls has been started with the construction of an aesthetic style boundary wall and levelling the area for the construction of an amphitheatre in future.
- 3. Leisure landscape focusing the Reservoir:** the reservoir formed of the dam in continuation of the Arboretum Road is deepened and shaped into in a picturesque shape to enhance the beauty of the landscape. It is proposed to fix water fountains as well as to arrange boating facility in future. The structural landscape works for constructions the construction of a huge carpet bed in the Arboretum side, to be viewed from the other side of the lake is started. Many flowering trees especially *Tabebuia* spp. scintillating the scene were planted in the Arboretum slope.
- 4. Shifting of Central Nursery Sales Counter:** in context of the central nursery landscape alterations of the sales counter is shifted to the area close to vehicle parking. For these

many terraces bounded with rubble protection wall were constructed to arrange the plants for sales. A sales counter with refreshing facilities is also constructed in the site.

5. **Infrastructure developments:** (i) Two greenhouses (each with 10 x 7.5 m) with a total of 150 m<sup>2</sup> area at Threatened Species Park were constructed in the external projects *viz.* *Green Kerala Initiative* and Conservation, Eco-restoration and Popularization of three endemic and threatened tree species of Kerala, India.
6. (ii) **Metallic fencing** protecting the important garden areas from wild animal attack *viz.* about 60 m provided surrounding the ‘herbal figure bed of Gandhiji’ and 90 m surrounding the ‘Emblem bed’; 600 m around Garcinia Garden; 300 m at Threatened Species Park; 332 m around Fenery were constructed. (iii) Temporary shed with UV roof (4 mtr long x 3 mtr. Breadth) have been constructed in Fruit crops section (iv) Constructed Gallery style display terraces in Aquatic plants conservatory for displaying educationally as well as ecologically important aquatic species.
7. **Carpet grass lawn:** About 2000 sq. ft frontage of the commercial tissue culture lab is provided with carpet grass lawn with a *Calathea* bed at the centre.
8. **Interlock paving:** About 50 m<sup>2</sup> rubble projecting area of the entry of the road leading to the fruit plant garden is paved with interlock.
9. **Aquatic conservatories display gallery:** Gallery style display frame for the educational demonstration of Aquatic plants, is constructed near the reservoir. The structure comprises of five numbers of two feet broad stepping terraces outward and three numbers inward. Species having ecological importance are systematically labelled and displayed.



Aquatic conservatories display gallery

**10. Topiaries:** Many topiaries including the 3 ft. high 'PALMETUM' letters done of *Ehretia microphylla* make the entrance layman enthusiastic.

**11. New accessions added:** During the report period different theme plant groups of Garden Management Division got added with 286 new accessions.

**12. Seedlings distributed:** 2663 numbers of seedlings of IUCN Red listed endemic trees were distributed to 12 different government or quasi government agencies on future monitoring basis.

**13. Income generated:** Total income generated **Rs.27,24,838/-** (Rupees twenty-seven Lakhs twenty-four thousand eight hundred and thirty-eight only).

1. Plant sale: Rs.16,03,408/-

2. Entry fee: Rs.11,21,430/-

### **Trainings and Extensions**

1. Training on Nursery Management and Administration: 12nos. of B.Ed. students from

Iqbal College 22 - 26 May 2023.

2. Sasthrasamisha, (KSCSTE funded) programme - (5 days) to about 450 students: Scientists and Technical Officers of the division participated.
3. One day training on Forest Ecosystem acquaintance for 120 nos. of National SPOT Qualified children arranged by VSSF, Kochi.
4. One day training for farmerson vegetative propagation of plants: 25 farmers from Elamad Grama Panchayat, Kollam sponsored by ATMA on 13 November 2023.
5. 21,916 visitors including students visited the garden and got aware of botanical knowledge/ plant conservation.



Farmers from Elamad Grama Panchayat, Kollam receives training on the vegetative propagation of plants.

### Technology Deployment for Socio-economic Development

1. In the KSCSTE funded “Green Kerala Initiative” project 5944 seedlings of RET species belong to different IUCN Red- listed endemic species were distributed to 5 responsible agencies to be monitored the follow-up activities in the coming forth 5 years.
2. As a part of KSBB funded projects the deteriorating sacred grove of Poredam Mahadeva Temple is restored.
3. The Chirayeezkizhu block panchayat office premises are developed into an eco-park in respond to the funding from the panchayat.

## PLANT GENETIC RESOURCES DIVISION

The PGR Division undertakes diverse activities on taxonomic, biosystematic and phytochemical studies, breeding experiments to produce new hybrids, studies to utilize the resources in a sustainable manner and extension/ awareness activities along with its chief mandate on enrichment of the genetic resources of Medicinal and Aromatic plants, Bamboos, Orchids, Carnivorous plants *etc.* and maintaining the existing resources in the garden.

### Medicinal, Aromatic & Spice Plants Unit

*Ex-situ* conservation of genetic resource of selected medicinal plants and assessment of intraspecific variability is an ongoing programme through which characterization of selected medicinal plants are being carried out. Catalogued the list of medicinal plants in the medicinal garden and plants in the Ginger House were reorganized. Established a Spice Plants Corner in the Medicinal Plants Garden with *Cinnamomum zeylanica* (Cinnamon), *Garcinia campogea* (Camboge), *Myristica fragrans* (Nutmeg), *M. pushpangadaniana*, *M. beddomei*, *Alpinia galanga*, *Eugenia caryophyllata* (Clove), *Alpinia galanga* (Greater Galanga), *Murraya koenigi* (Curry leaf), *Zingiber officinale* (Ginger), *Curcuma longa* (Turmeric), *Pimemta dioica* (Allspice), *Piper nigrum* (Pepper), *Vanilla planifolia* (Vanilla), and *Tamarindus indica* (Tamarind).

As part of propagation trials, seeds of cultivar variety of *Aegle marmelos* collected from N-E India, *Clerodendrum indicum*, *Rauvolfia serpentina*, *Commiphora wightii*, *Ipomea turpethum*, *Ampelocissus indica*, *Abutilon indicum*, *Asparagus densiflorus*, *Couroupita guianensis* subjected for germination trial in the Germinator/ nursery. Observed highest germination percentage in the seeds of *Ipomea turpethum* at 12% Moisture Content (MC). *Aegle marmelos* attained 100% germination at 10.13% MC. *Ampelocissus indica* seeds showed 60%, 50% and 60% germination at 33.3%, 20.2% and 12.4% MC respectively, which showed that germination percentage not correlated to MC. *Asparagus densiflorus* seeds showed 80% germination at 39.93% MC and 40% germination at 30.3% MC. Viable seeds of *Abutilon indicum* didn't show good germination percentage at laboratory conditions. Seeds of *Asparagus densiflorus*, *Clerodendrum indicum* and *Withania somnifera* were deposited in the Seed Bank active collection (Accession no. TSB:167.4.3.1.23, TSB:120.49.1.1.23, TSB:112.15.1.1.23). Examined the survival rate in herbaceous, soft wood and semi hard wood cuttings of *Premna serratifolia*. Air layered *Aquilaria malaccensis*, *Woodfordia fruticosa* and *Aegle marmelos*. Cuttings of *Woodfordia fruticosa*, *Rubia cordifolia*,

*Commiphora wightii* were planted in pots for propagation. Seeds of *Aegle marmelos* were sowed and reared 40 seedlings. Planted *Rauvolfia serpentina*, *Aegle marmelos*, *Syzygium* sp. and *Cochlospermum religiosum* in pots.

Saplings of two *Ipomoea mauritiana* were issued to National Ayurveda Research Institute for Panchakarma (NARIP) Cheruthuruthi, Kerala on payment basis. Vegetative cuttings of *Plumbago indica*, *Vitex altissima*; seeds of *Clitoria ternatea*; fruits & leaves of *Garcinia intermedia*; leaves of *Cymbopogon citratus*, *Pandanus amaryllifolius*, *Hemigraphis colorata* were issued to three divisions of JNTBGRI.

Planted *Pterocarpus santalinus*, *Bauhinia variegata*, *Aesculus assamica*, *Saraca indica*, *Callicarpa tomentosa*, *Datura* sp., *Tiliacora acuminata*, *Clitoria ternatea* (Variant), *Piper chaba*, *Asparagus racemosus* (Chhattisgarh), *Artemisia vulgaris* were planted in the medicinal garden. *Erythrina stricta*, *Calophyllum inophyllum*, *Bauhinia variegata* and *Adhatoda vasica* were planted in the Itty Achuthan Vaidyan's garden. Pruned overgrown tree branches, lianas; removed a fishtail palm at the entrance of Itty Achyuthan Vaidyan's Garden and infected *Cipadessa baccifera* was replaced. Herbal beds were mulched with areca nut husk and manured with cow dung. Blockage and leakage problems in the pipeline from the Chittar river for enriching the water bodies in the Itty Achuthan Vaidyan's Garden were resolved.

Collected and stored herbarium specimens and leaf samples of 25 species as part of 'Biorepository of Western Ghats Medicinal and Aromatic Plants'. Population monitoring of *Garcinia gamblei* and seed germination studies are under progress. GA3 treated sandal seeds (200 nos.) sown in polybags, monitored germination and observed the survival rate of transplanted individuals and seedlings as part of 'Conservation of Vulnerable Sandal wood through propagation and reintroduction'. 100 sandal seedlings handed over to Thenmala Forest Division.

### **Field Gene Bank and Conservatory of Andaman & Nicobar Plants**

Plant exploration was conducted to South Andaman Islands and 12 accessions with 8 live specimens and 5 seed samples were introduced. A total of 138 herbarium specimens belonging to 50 species under 25 genera in 19 families were referred at BSI, Port Blair. Prepared a brochure on 'Conservatory of Andaman and Nicobar Plants'. As part of the documentation of Andaman & Nicobar plants at JNTBGRI, 130 micro/ macro photographs of

flowering, fruiting, habit *etc.* of each species were photographed. Ten Andaman species established in the field were identified, and 80 herbarium specimens were processed.

Seeds of *Calamus baratangensis*, *Calamu sandamanicus*, *Ardisia littoralis*, *Knema andamanica* and *Cycas zeylanica* were sowed. Established accessions of *Costus speciosus*, *Pandanus tectorius*, *Thysanolaena maxima*, *Pterocarpus dalbergioides* and 30 RET plants were repotted. Nursery established plants of 22 species were planted into the Andaman field conservatory. Repaired the partially damaged conservatories and maintained fencing around the demonstration plants at FGB. Maintenance of major trails, under growth clearing, mulching and pruning of trees were carried out in the Andaman field plot.

### **Bamboo Biology Unit**

Conservation of Bamboos at JNTBGRI is an ongoing plan funded project through which the Bambusetum of the Institute is being developed and maintained. Plant exploration was carried out to Vadamon, Anchal and Palode and collected offsets and seedlings of Giant bamboo and *Bambusa bambos*. Evaluated the mechanical superiority of *Pseudoxytenanthera* bamboo for sustainable engineering solutions and revealed that *Pseudoxytenanthera* species, especially *P. stocksii*, possess superior chemical and mechanical properties. *P. stocksii* exhibits higher cellulose, hemicellulose, lignin, and pectin content, making it a chemical standout. Additionally, it demonstrates greater tensile strength and thermal stability, making it suitable for high-temperature applications. These findings underscore the potential of different bamboo species, particularly *P. stocksii*, in eco-friendly composites and construction materials, promoting sustainability in industrial sectors. The rhizome geometry of *Melocanna baccifera* was studied by exposing the underground rhizome system and scientific topographic survey.

A total of 87 crosses were done in bamboos. A sum of 5583 seedlings/ tillers of 26 species were planted and rooted tissue culture plantlets of Golden bamboo were transferred for hardening. Twigs of 2 bamboo species issued to Phytochemistry and Phytopharmacology lab. Bamboo product models prepared with dry bamboos and maintained topiaries & hedges at Bambusetum.

### **Orchid Biology/ Carnivorous Plant Unit**

The unit deals with germplasm of Orchids, Carnivorous Plants and Anthuriums. 'Establishment and Upkeep of a National Collection of Orchids' is an ongoing plan funded programme through which daily maintenance and upkeep of the orchidaria are continued. A

total of 78 accessions (*Anthurium* hybrids, orchid species/ hybrids, and carnivorous plants) were introduced/ reintroduced. A sum of 328 seeds of *D. spatulate*, *Drosera* sp. and *Anthurium bakeri* were sown. Planted 52 species collected from Northeast India in Orchidarium. A total of 3252 plants in 23 varieties (*Anthurium* hybrids, orchid hybrids, and carnivorous plants) were potted/ re-potted. Orchids were demonstrated in the newly constructed frame and pesticides & fertilizers were applied on appropriate intervals. Data collection and observation of flowering *Grammatophyllum speciosum* was done. Orchid breeding is an important activity of the Unit. Thirteen interspecific/ intergeneric crosses were carried out. Ten capsules of orchid species/ hybrids were harvested, and establishment of cultures is in progress. Pitchers of 2 *Nepenthes* species, 2 hybrids (*Nepenthes mirabilis* and *N. mirabilis x N. refflesiana*) and nectar given for analysis in the Phytochemistry lab.

### **Tissue Culture Unit**

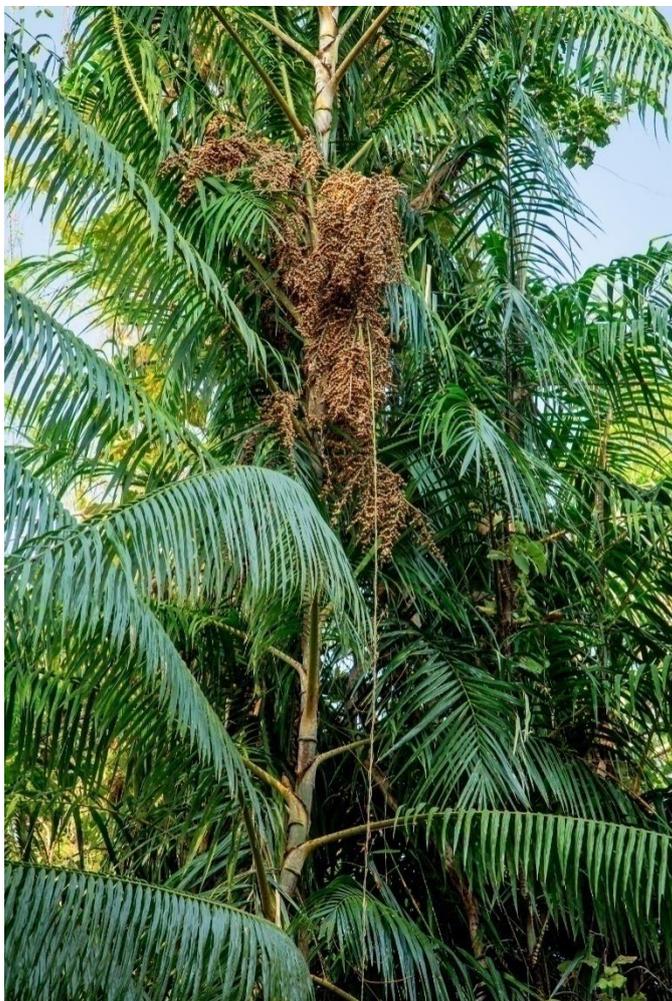
The Tissue culture Unit of the Division is working on non-conventional propagation of selected commercially important plants as part of institute's Lab-to-Land Programme and generating income for the institute. Under mass multiplication programme for ornamentals, micropropagation is being carried out in 23 potential taxa comprising hybrids of *Anthurium* and Orchids.

Inflorescence of Banana var. charapoovan, Nendran, *Dendrobium aphyllum*, *Dendrobium Sonia White* and 2 new orchids were subjected for fresh culture and *Vanda tessellata*, *Dendrobium Sonia white*, *Cymbidium* in protocorm and seedling stage, *Rhyncostylis retusa* in seedling stage and *Mokara charkkuan pink* in protocol stage were subcultured. Orchids viz. *Dendrobium White*, *Dendrobium Double Colored*, *Dendrobium Venus*, *Dendrobium Indigo Blue*, *Phalaenopsis White* and Banana varieties such as Nendran, Red, Matti, Poovan, Robusta and Palayamcodan plants were repotted for secondary hardening. protocol standardization for mass multiplication of *Dendrobium Sonia White* using nodal explant was done. A total of 26,435 bottles of tissue cultured plants were produced and 20,925 culture bottles were inoculated aseptically through specific protocols including fresh culture and subculture. During the period, 49,606 tissue cultured ornamental plants and bananas were deflasked and 6,926 plantlets established in the laboratory conditions were transplanted for field hardening.

### **Upcoming Programme**

Establishing a Biorepository for the Plants of the Andaman Islands, funded by Global Genome Initiative for Gardens (GGI-Gardens Award), funded by United States Botanic

Gardens & Botanic Gardens Conservation International, Richmond, UK. (2024-2025). As part of this programme, gene sequencing and herbarium specimens of some endemic and economically important plants of the Andaman Islands are to be prepared by the JNTBGRI.



*Calamus andamanicus* in fruiting at JNTBGRI.

*Calamus andamanicus* Kurz is endemic to Andaman and Nicobar Islands, enlisted as Vulnerable in 1997 IUCN Red List of Threatened plants. This species is an important commercial rattan used in the furniture industry and exported to mainland & European countries. The plant is well established at JNTBGRI Andaman conservatory by attaining a length of 100 meters.

#### **Income generated**

An income of Rs. 8,47,316/- (Eight lakh forty-seven thousand three hundred and sixteen only) generated from sales of plants/ products through various units of PGR Division.

## BIOTECHNOLOGY AND BIOINFORMATICS DIVISION

The Biotechnology and Bioinformatics Division, established in 1982 as the first R&D division of JNTBGRI, initially focused on seed and tissue culture of orchids, anthuriums, philodendrons, and haploid plant production in *Cassava*. Since the 1990s, its scope has expanded to include:

(i) Conservation Biotechnology: *In vitro* protocols for conserving and multiplying economically and ecologically significant plants, and seed physiology studies for efficient germination. (ii) Bioproduction: Secondary metabolite production using cell, root, hairy root cultures, and hydroponics. (iii) Molecular Biology: Genetic variability testing and gene identification for plant conservation and utilization. (iv) Bioinformatics Centre: Development of biodiversity databases and bioprospecting medicinal plants for therapeutic leads. (v) Tissue Culture Unit: Large scale production and supply of planting materials, transfer of tissue culture protocols and offering industrial training in plant tissue culture. (vi) Saraswathy Thangavelu Extension Centre: Cultivation of orchids, ornamental crops, and practical application of research findings. The division also supports human resource development, technology transfer, consultancy, eco-restoration, and reintroduction of rare and extinct species into their native habitats.

### Important achievements

#### (i) Conservation Biotechnology

Seed germination and *in vitro* tissue culture protocols were standardized for three critically endangered species namely, *Dalium travancoricum*, *Cinnamomum agasthyamalayanum* and *Syzygium caryophyllatum* var. *abrahamianum*. Demonstrated mosquito repellent properties of *Etlingera fenzlii*, with trials underway for a formulated repellent from its essential oil. Maintained *in vitro* cultures of over 60 plant species with conservation important and initiated large scale production and reintroduction of orchids and medicinal plants into its native habitat. Additionally, conservatory of RET species with tissue cultured plants will be launched shortly. Project specific achievements are given below

#### Species Distribution Modelling and Bioprospecting of *Salacia* species

The National Medicinal Plant Board, Govt. of India sponsored project programme undertaken by Dr. R. K. Radha as PI. This programme aimed to identify high-value antidiabetic plants from the Western Ghats. Germplasm of 11 species (45 accessions) was collected and maintained in the *in vitro* repository and field gene bank at JNTBGRI with proper

registration. The mangiferin content, anti-diabetic, and anti-lipidemic properties were analyzed across species to identify the most suitable raw materials for drug formulations. Species-specific markers were developed to ensure the authenticity and safety of raw materials used in traditional medicine. Replicates of the germplasm, along with passport data, were deposited at ICAR-NBPGR, Thrissur, as per Ministry of Ayush guidelines.

### **Habitat Distribution Modelling and Conservation of Threatened Trees in the Kerala Region of the Western Ghats for the Improvement of Their Conservation Status**

This project sponsored by MoEF & CC, Govt. of India and the major achievements: Accomplished inventory/ distribution modelling/ passport data of the wild population of the threatened trees targeted *Buchanania barberi*, *Buchanania lanzan* var. *palodensis*, and *Calophyllum apetalum* across the Western Ghats. The project documented the wild populations of these species and standardized zygotic embryo cryopreservation and *in vitro* regeneration protocols to enhance their conservation status.

### **Biotechnological interventions for defensible conservation and restoration of *Dialium travancoricum* Bourd., a Critically Endangered Endemic Tree of the Southern Western Ghats**

Under this project, funded by SPG-SERB, DST, Dr. R. K. Radha carried out inventory and distribution modelling of this critically endangered tree endemic to the Southern Western Ghats. Zygotic embryo cryopreservation and *in vitro* regeneration experiments are currently underway to ensure its survival.

### ***Ex situ* conservation, chemical and molecular profiling of sweet flag (*Acorus calamus* L.) germplasm from the Western Ghats**

The project undertaken by Dr. R. K. Radha focused on phytochemical and genetic characterization of germplasm from the Western Ghats. This study identified an elite genotype with negligible  $\beta$ -asarone content, aligning with WHO safety standards for medicinal and food use. Molecular profiling using ISSR, ScoT, and DAMD markers enabled the identification of accessions with low  $\beta$ -asarone content for safer medicinal applications.

### **Utility of semiochemicals and analysis of *Etligeria fenzlii*, an endemic plant species of the Andaman and Nicobar Islands in mosquito management**

Under this programme Dr. R. K. Radha, investigated the insecticidal properties of this endemic Andaman and Nicobar species. The plant was confirmed as a mosquito repellent against *Aedes aegypti* and *Culex quinquefasciatus*. A repellent formula developed from the

plant's essential oil demonstrated an enhanced complete protection time of 60 minutes compared to lemongrass and DEET, with commendable safety up to 2000 mg/kg for topical application on Wistar albino rats.

### **Scale up production of quality planting material of RET, endemic and high demand Medicinal Plants (MPs) for custom farming at Chhattisgarh State Medicinal Plant Board**

Under this programme, successfully scaled up tissue culture production of medicinal plants, including *Acorus calamus*, *Plumbago rosea*, *Ophiorhiza mungos*, and *Curcuma zedoaria*, producing planting materials in lakhs for custom farming.

Finally, the *ex-situ* Conservation of RET listed Medicinal Plants has been an ongoing effort since 2006 under projects financed by DBT and NMPB. The initiative focused on conserving medicinal plants such as *Acorus calamus*, *Curcuma* species, *Rauvolfia vomitoria*, *Salacia* species, and others through *in vitro* propagation and reintroduction into natural forest habitats. Nutrient media have been optimized to maintain these plants in the *in vitro* repository for long-term conservation.

#### **(ii) Bioproduction**

Standardized the best medium for hydroponics culture of *Plectranthus vettiveroides* and demonstrated reasonable amount of essential oil production, demonstrated *in vitro* anti-diabetic, anti-hepatitis B and anti-tuberculosis activities. *In silico* methods identified potential lead molecules, highlighting its promising therapeutic applications. Experiments on large scale production of roots and essential oil in hydroponic system are progressing.

#### **(iii) Molecular Biology**

Molecular changes in *Amaranthus tricolor* due to temperature stress: The study focused to reveal the morphological, biochemical and molecular changes in *Amaranthus tricolor* under high temperature. *A. tricolor*, a plant originally from the tropics can be grown in a wide range of climates from the temperate zone to the tropics. It grows best in areas where annual daytime temperature is within the range 22 - 30°C. Any temperature below or above the optimum is considered as stress to them. The knowledge behind the stress tolerance could be exploited to create variety of stress resistant crops that could be beneficial to agriculture. During the work, *A. tricolor* of about 2 weeks of age, were exposed to high temperature [40 °C]. Leaf samples were retrieved after 4 hour and were subjected to morphological, biochemical and gene expression studies. All these aspects were also studied in control plants

[25°C] for ideal comparison. Morphological analysis during the treatment exhibited minor symptoms of stress induction like leaf wilting, rolling, changes in leaf colour *etc.* Further biochemical changes proved a decline in chlorophyll content, anthocyanin and phenolic content in the treated plant when compared to control plants. Ultimately gene expression study established the increased expression of target gene SOD after temperature treatment.

### **Phylogenetic analysis of *Orophea* genus**

*Orophea* is genus of flowering plants belonging to the *Annonaceae* family that is found in Southern and South-eastern regions of the Asian continent some of its islands. *Orophea* occurs in the wild as trees and shrubs. While the exact uses for *Orophea* aren't completely understood, some species of *Orophea* are reported as medicinal. *Orophea erythrocarpa* and *Orophea uniflora*, obtained from the custard apple garden of JNTBGRI were used for DNA barcoding. The samples were collected and DNA extraction of the 2 species was carried out using the CTAB method. Methods like AGE and Nano photometric analysis were used to analyse the presence and purity of the DNA in the extracted samples. Gene specific primers like RbCl, TrnI-F, PsbA, TrnH *etc.* were used for PCR analysis. The amplification implied the effectivity of the selected primers and documentation of the amplified samples was conducted for aiding DNA barcoding which helped in finding relatedness and genetic differences between the 2 species in question. Further phylogenetic analysis of the members of the *Orophea* species and two closely related species belonging to *Annonaceae* were conducted via the MEGAX software. Sequences of the members of the *Orophea* species were selected and downloaded from the NCBI database after carefully selecting appropriate species and genes. Thus, through DNA barcoding, relatedness of 2 species of *Orophea* were analysed.

### **Genetic diversity analysis of *Curculigo orchioides***

This work aims to provide comprehensive details about genetic diversity and phytochemical analysis of *Curculigo orchioides*. In this study, 5 random primers were used for genetic diversity analysis of *C. orchioides* that were collected from 10 different places in the southernmost part of Kerala (Thiruvananthapuram, Kollam, Pathanamthitta). Eight ISSR primers generated 79 fragments in 10 accessions of *C. orchioides*. Total number of fragments amplified ranged from 6 to 13. Maximum numbers of amplicons were generated by primer ISSR 848 (13 bands) and least by primer ISSR 811 (6 bands). The Eight ISSR primers generated 76 polymorphic bands and 3 monomorphic bands. The genetic distance was

calculated by tree construction software and the systematic diagram of the genetic relationship was clustered by UPGMA method. The UPGMA clustering algorithm grouped the accessions into two clusters and two out groups from one ancestor. The first cluster contains 6 accessions (KTCR8, KKAP2, KKL10, KTPT9, KKT4 and KPPT3). The second cluster contains the 2 accessions (KTKL6 and KKMT5). KTPL1 and KTSM7 stands as a branch. The genetic similarity between the 10 accessions of *C. orchoides* on the ISSR data ranged from 12% to 47% by using Jaccard similarity. The mean genetic similarity among the 10 accessions of *C. orchoides* was 97.59%. The highest similarity (47%) was observed between KPPT3 and KKT4, KPPT3 and KTSM7, KTKL6 and KTSM7, KTCR8 and KKL10. The lowest similarity (12%) was observed between KKPT9 and KTPL1. The phytochemical analysis of *C. orchoides* extract revealed the presence of curculigoside. Methanolic extract of rhizome revealed the presence of curculigoside at the wavelength of 283nm by UV Visible spectrophotometer. This technique can be used to quantify the phytochemicals that show diversity. This method could be used to control the quality of crude medicine *C. orchoides*.

### **Unraveling MicroRNA Mediated Gene Regulation in *Centella asiatica* (L.) Urb. by high-Throughput Sequencing Based Small-RNA Profiling**

*Centella asiatica* is a widely spread herb mostly found in the tropics having extensive medicinal values. Transcriptome-wide characterization of miRNA profile from the leaves of *C. asiatica* using high-throughput Illumina sequencing is reported for the first time from JNTBGRI. Current study identified 227 conserved and 109 putative novel miRNAs. Computational screening revealed potential mRNA targets for both the conserved and novel miRNAs encoding diverse transcription factors and enzymes involved in plant development, disease resistance, metabolic and signaling pathways. Gene ontology annotation and KEGG analysis revealed the miRNA targets to be involved in a wide range of metabolomic and regulatory pathways. The differential expression of the miRNA encoding genes in diverse tissues was determined by real-time PCR analysis. It was found that gene expression levels of miR156, 159 and 1171 were reduced in salicylic acid treated axenic shoot cultures of *C. asiatica* compared to its control. Furthermore, RLM-RACE experiments mapped miRNA-mediated cleavage at two of the mRNA targets. The present study represents the large-scale identification of microRNAs from *C. asiatica* and contributes to the base for the upcoming studies on miRNA-mediated gene regulation of plant secondary metabolite pathways.

#### **(iv) Bioinformatics Centre**

##### ***In silico and in vitro* screening of SARS CoV-2 activity**

The anti-SARS-CoV-2 potential of phytochemicals derived from selected medicinal plants was evaluated using *in silico* and *in vitro* approaches. A total of 2,554 phytochemicals from twelve medicinal plants were screened using AutoDock Vina, resulting in the identification of a promising lead compound. Methanolic extracts were prepared from the fruits of the selected plants and analyzed using High-Resolution Liquid Chromatography-Mass Spectrometry (HR-LCMS) and High-Performance Thin-Layer Chromatography (HPTLC) for phytochemical profiling and quantification. Cytotoxicity assays confirmed the safety of the lead compound and pomegranate peel extract (PPE) at effective concentrations. Cytopathic inhibition assays demonstrated significant anti-SARS-CoV-2 activity, with PPE (50 µg/ml) and the lead molecule (5 µM) reducing viral copy numbers by 75% and 50%, respectively. Furthermore, PPE exhibited dose-dependent inhibition of cyclooxygenase (COX) and lipoxygenase (LOX) enzymes, indicating its anti-inflammatory properties. These findings highlight the potential of the identified lead compound and PPE derived from *Punica granatum* as promising candidates for further development in the treatment of SARS-CoV-2.

Created a library of 120 phytochemicals derived from the antiviral plant *Nerium oleander* L., with primary details including name, molecular formula, molecular weight, canonical SMILES, and PubChem compound ID (CID), along with references.

Incorporated 25 anti-SARS CoV-2 plants' data on the database anti-viral plants

##### ***In silico* screening of anti-cobra venom activity**

Screened a library of 1800 phytomolecules against 14 cobra venom proteins using AutoDock Vina and PyRx 8.0 to evaluate binding potential. Compounds with binding energies  $\leq -6$  kcal/mol were shortlisted based on multi-target activity and analyzed for ADMET properties and molecular interactions. Molecular dynamics simulations (100 ns) with GROMACS 2018.1 identified lead molecules with multiple targets inhibitory activity.

Incorporated 93 anti-snake venom plants' data on the database anti-viral plants

### ***In silico* screening of anti-dengue and Hepatitis C viruses**

A total of 1794 phytochemicals from seven plant species such as *Aristolochia indica* L. (85), *Clitoria ternatea* L. (54), *Illicium verum* Hook.f. (250), *Mentha arvensis* L. (482), *Nerium oleander* L. (234), *Saccharum officinarum* L. (92) and *Citrus limon* (L) Osbeck (597) against both the targets of dengue (Ns5 Mtase and RDRP domains and IMPDH-2) and Hepatitis C virus (NS3-4A and NS5 polymerase). It results in nine leads against dengue and six leads against hepatitis C viruses.

Identified eight compounds, including Oleanolic acid, Odoroside, Betulinic acid, Oleandrin, Neriine, Digitoxigenin, Cardenolides, and Methandrostenolone, with binding free energies ranging from -10.9 to -8.4 kcal/mol as top hit compounds against the Dengue virus envelope protein.

Pharmacokinetic analysis of the hits identified two potential anti-dengue compounds, Digitoxigenin and Cardenolide, for further wet lab investigation

### **Database on antiviral plants with emphasis on nutraceuticals: *In silico* validation of phytochemicals and formulation of a herbal product**

As part of the Kerala State Biodiversity Board-sponsored project, data from 78 plants were incorporated into the database. Additionally, 3,941 phytochemicals from 28 plant species were screened against four SARS-CoV-2 targets, resulting in the identification of 20 promising lead molecules with multi-target inhibitory activity.

#### **(v) Plant Tissue Culture Unit**

Mass Production of Ornamentals: Micropropagation is being carried out for 24 high-value ornamental taxa, primarily *Anthurium* and Orchid hybrids. *Anthurium* hybrids, including Caesar Violet, Hawaii Orange, and Dora, are in the multiplication and rooting stages. Green capsule cultures of *Peristeria elata* have been initiated. Orchid hybrids, including *Phalaenopsis* (white and pink), *Dendrobium* species (e.g., Airy hybrid, Burana Splash, Venus, Red Dragon), *Spathoglottis*, *Cattleya* Pink, and *Vanda* Misjoaquam (new), are at initiation, multiplication, and rooting stages.

Micropropagation of Banana and Other Taxa: Multiplied five cultivars - Nendran, Poovan, Red Banana, Matti, and Palayamcodan - from disease-free suckers and inflorescences. The multiplied shoots were isolated, rooted, and transferred to the greenhouse. A total of 38,915

tissue-cultured banana plantlets were deflasked from 5,559 bottles and transferred for hardening.

**Contract Multiplication:** To promote innovation among farmers and nurserymen, a contract production facility was introduced for multiplying plants of their choice. During this period, four growers benefited from this facility. *In vitro* propagation was carried out for two orchid taxa, one banana taxa, and one ginger taxa, including some hybrids developed by the growers. A total income of ₹ 4,43,960 was generated through the sale of tissue cultured plants and training.

**(vi) Saraswathy Thangavelu Extension Centre (STEC)**

STEC-JNTBGRI, Puthenthope, focuses on multiplying and selling vegetable seeds (18 varieties), coconut seedlings, various fruit plants, and ornamental plants. It also maintains 600 coconut palms and 23 different varieties of mango trees. In addition, conserves *Plectranthus vittiveroides*, an endemic and threatened species in the wild, for essential oil production. Furthermore, evaluated 85 accessions of chilli germplasms and identified superior varieties with drought, pest, and disease resistance, including a perennial type, which is growing and providing stable yield since last nine years. On the main campus, 50 species of anti-snake venom plants, 100 medicinal plants, and 600 ornamental plants (including 23 heliconia varieties, 30 croton varieties, 32 Hibiscus varieties, and wild orchids) are conserved. Introduced 85 new accessions of orchids, 25 new accessions of ornamental and medicinal plants into the garden. A new mango variety has been identified, and its nutritional quality and quantity were analysed. It will be registered as a new variety shortly. In view of providing quality planting materials to the public a total number of 20000 plantlets of various ornamental plants and 20 kg different vegetable seeds have been produced for sale. A large-scale cultivation demonstration plots of monopodial orchids such as Aranthera Anne Black, Arachnis Maggie Oei yellow Ribbon and Arachnis Maggie Oei Varigated are maintained in the garden. These constitute over 30000 plants, and nine new orchid beds consists of 2250 plants were raised from the top cutting of Aranthera Anne Black. Introduced 15 new *Phalaenopsis* hybrids at STEC-JNTBGRI, Puthenthope.

**(vii) Technology transfer**

The University of Kerala launched a digital herbarium, developed by the Bioinformatics Centre, JNTBGRI, on May 23, 2023. Out of the sanctioned 10 lakhs, Rs. 5.00 lakhs were allocated towards the cost of the database package.

The billing and visitors' management software application was updated and handed over to VMC for handling visitors' entry fee billing and data documentation.

**(viii) Consultancy**

A statue of G.V. Raja (full size-12 feet height with proportionate size statue created on 4 ft x 4 ft width x 10 ft heightbasement) associated with aesthetic landscaping and garden (5000 m<sup>2</sup> area) was created at the G.V. Raja Sports School campus, planted anti-viral plants around the institute of Advanced Virology campus and undertaken the garden maintenance at Energy Management Centre.

**Income generation**

Total income generated by the Biotechnology & Bioinformatics Division during the reported period is ₹ 2001720/-

(Training and sale Rs. 777280 + Technology transfer Rs. 500000 + Consultancy fee from EMC Rs 48000 + Consultancy from IAV Rs. 20000 + Tissue culture unit after taking over Rs. 206440 + 450000 sale of acacia wood)

**CONSERVATION BIOLOGY DIVISION**

The division works on threatened plant species and ecosystems for a deeper understanding on the reproductive process, genetic makeup, gene flow systems, interaction with animals *etc.* to evaluate the reasons of rarity and extinction. The results of these studies will augment the managers and policy makers to take appropriate actions to slow down the loss of biodiversity. Apart from maintaining a pollen herbarium, efforts are also going on in the division to conserve germplasm through Seed Banking.

In line with the guidelines and approval of the Research Advisory Committee, in-house projects are running on threatened plant species and ecosystems for a deeper understanding on the reproductive process, genetic makeup, gene flow systems, interaction with animals *etc.* to evaluate the reasons of rarity and extinction and externally funded inter institutional projects are going on for helping to take appropriate actions to conserve tropical plants. Field observations are in support of *ex-situ* conservation as a concerted effort in the campus as well as with other designated areas based on published results. Efforts are also going on in the division to conserve the germplasm through palynology and seed banking.

## **Documentation of Flowering Plants of India**

India harbours 22,214 species of flowering plants (Plant Discoveries 2023). Even though numerous publications dealing with regional, district and local floras appeared, a comprehensive account on flowering plants of India is yet to come. As 7,402 species has already been worked out for the preparation of Flowering Plants of the Western Ghats, India (Nayar *et al.*, 2014), Flowering Plants of India is a logical extension. During the period under report, collected, revised and added data of species from Kashmir, Himachal Pradesh, Madhya Pradesh, Sikkim, Panjab, Nagaland, Assam and Meghalaya, referring to 9602 species. Updated local names and phenology of these states also from the respective references. Added 1,554 species newly to the texts from these references. Collected 345 online references pertaining to new species, new records, revisions and rediscovery related to flowering plants of India and added 48 species from these references.

### **Seed Bank**

Collected seeds of 291 taxa comprising 219 species of 158 genera from 68 families. The collection includes 19 endemic species. Germination studies of 9 species were carried out. Seedlings (749 Nos.) of 19 species were given to different garden sections for field enrichment.

### **Palynology Laboratory**

A Palynology unit is attached to the Division of Conservation Biology. The laboratory focuses on the applications of pollen morphology in areas of taxonomy (systematic palynology), identification of drug adulteration (pharmaco-palynology), pollen in honeys (mellisso-palynology), in criminal investigation (forensic palynology) and plant animal interaction. It maintains a sporotheca which carry 12,000 pollen and spore slides of 1,100 species of angiosperms, 60 species of Pteridophytes, 300 honey samples and 6 animal fur samples. The following works were completed during the period.

#### **Pollen morphology of the variants of *Pellionia heyneana* Wedd.**

This investigation was in collaboration with Dr. Mathew Dan, Scientist and Murugesan, JRF of the Division of Garden Management, Education, Information, and Training as part of the variability study of *Pellionia heyneana* variants in the Western Ghats. The aim was to study the pollen morphology of the variants of *Pellionia heyneana*. Light microscopic observations were carried out using Nikon Eclipse 80i model light microscope. Quantitative and

qualitative morphological characters: polar outline, equatorial outline, pollen size, aperture type and size, ornamentation, exine thickness, apocolpium, mesocolpium *etc.* were analysed.

### **Identification of the pollen in the honey of *Trigona tetragonula***

*Trigona tetragonula* is a small stingless bee seen throughout Kerala. Though it produces only small quantity of honey, it costs more than 3000 INR in the market. This study was undertaken in association with the Kerala Agriculture University, Mannuthi with the broad aim to identify the major pollen grains in the honey to understand the most preferred plants by honeybees for collecting nectar. This would help the beekeepers to increase the production of honey through planting more bee preferred plant species or keeping the beehives near to bee preferred plant species. Identification of pollen grains in honey samples collected from all the districts of Kerala was the task entrusted with our laboratory. The major pollen grains identified were *Cocos nucifera*, *Areca catechu*, *Caryota urens*, *Tridax procumbens*, *Chromolaena odorata*, *Stachytarpheta indica*, *Syzygium cumini* *etc.*

### **Conservation of *Dialium travancoricum* Bourd. (Leguminosae: Dialioideae), a critically endangered and endemic tree in the Western Ghats**

*Dialium travancoricum*, locally known as ‘Malam Puli’ is an endemic and endangered species occurring in Kerala. It is reported only from two different localities, Kallar-Ponmudi hills in Thiruvananthapuram District and Aryankavu forests in Kollam District in Kerala. It is an evergreen tree reaching 30 m height. A recent survey found that the species now survives with only one individual in Ponmudi forest in Thiruvananthapuram District and deserves immediate conservation attention. So, a programme was initiated in the year 2019 with the leadership of Dr. Anurag Dhyani, Scientist of the Division of Conservation Biology. The main aim of the programme is to develop as many as seedlings to establish more plants in both its habitat and in JNTBGRI campus. The programme also aims to conduct detailed surveys in the forest to locate more individuals of the species, phenological studies, pollination, seed set, seed dispersal, seed germination studies, seedling demography, environmental issues related to the long-term survival of the species.

Five field trips to Ponmudi were conducted to study phenology, pollination, and seed set and to survey the nearby localities to find out more individuals. Flowering was observed in November 2022. But no fruiting was observed. The observations are in progress.

## **Wildflowers of Silent Valley National Park**

This is an auxiliary outcome of many years field work in connection with different project works done in Silent Valley National Park. The work aims to bring out a coffee table book on the wildflowers with photographs and popular description to develop conservation awareness among common man. The work tries to explore the beauty of the flowers of about 100 species occurring in mid elevation forests of Silent Valley. Confirmation of identification, preparation of descriptions, correction of photographs and layout of the pages are in progress.

## **Population biology of *Humboldtia unijuga* var. *trijuga*, an endemic and endangered tree species of the southern Western Ghats and its conservation.**

*Humboldtia unijuga* Bedd. var. *trijuga* J. Joseph & V. Chandras. is a small tree of Leguminosae (Ceasalpinioidea) family, highly restricted to the southern Western Ghats with medicinal and ornamental potential. The main objectives of this SERB, Govt of India sponsored project are to study the spatial distribution, population structure and dynamics, study the genetic variation among and within populations employing molecular markers and to address the conservation issues related to seed set, recruitment, biotic and abiotic interactions, and seed biology. During the period under report, nine field trips were conducted to the study sites of Agasthyamala biosphere reserve. Molecular characterisation of the species was carried out. Fresh and young leaf samples from three different populations were collected. Each sample comprises one focal candidate tree and ten surrounding trees separated by a minimum distance of one metre. PCR reaction mixtures were prepared to a total volume of 15 $\mu$ L (containing 2 $\mu$ L of DNA sample, 7.5 $\mu$ L PCR mix, 3.5 $\mu$ L double distilled water and 2 $\mu$ L of primer). The amplification was performed using Eppendorf Thermocycler with a cycle start at 94 $^{\circ}$ C for 2 minutes; followed by denaturing at 94 $^{\circ}$ C for 15 seconds by 35 cycles; annealing for 15 seconds at 37 $^{\circ}$ C; and product extension for 5 minutes at 72 $^{\circ}$ C. The products of PCR after primer amplification were subjected to gel electrophoresis (3gm Agarose in 200ml TE buffer and 4 $\mu$ L Ethidium Bromide) and visualised under Gel documentation system.

Ten ISSR primers generated 121 fragments in 33 accessions. The size of the amplified products ranged from 100 to 1500 bp. Total number of fragments amplified ranged from 6 to 19. Maximum numbers of amplicons were generated by primer ISSR 817 (19) and least by ISSR 820 (6). The ten ISSR primers generated 101 polymorphic bands and 20 monomorphic bands. The number of polymorphic fragments ranged from 3 to 18. Maximum numbers of

polymorphic fragments (18) were observed in ISSR 817 (94.7%) least (3) by ISSR 820 (50%). The number of monomorphic fragments ranged from 1 to 3. Maximum number of monomorphic fragments (3) was observed in ISSR 820 (50%) and least (1) by ISSR 857 (12.5%), ISSR 817 (5.3%). The average percentage of polymorphism was 83.5%. The similarity coefficients generated from the ISSR data were used to construct the dendrogram based on the Jaccards coefficient. UPGMA clustering algorithm grouped the accessions into 2 clusters. Further molecular characterisation and statistical analysis are progressing.

### **Triparty action plan for the reintroduction of red listed plants of Kerala**

Targeted surveys were conducted for locating the populations of *Hopea racophloea*, based on the information on species as shown in regional floras, herbaria, and other publications. During the period under report, Kollam and Thiruvananthapuram Districts were explored. For the reintroduction of the species and to establish a field Gene bank. Discussion was made with Forest Officials including DFO, Wildlife Warden and Foresters of Shenduruny Wildlife Sanctuary. Subsequently, it was decided to establish a field gene bank at Rosemala Forest area with 25 seedlings each on 4<sup>th</sup> October 2023 (Plot 1 - Pallivasal Starting area- Pathekar, GPS Points-N 08°54'48.95"E 077°10'58.59", Ht-268m; Plot 2 - S Valavu, GPS Points-N 08°54.648' E 077°10.870'; Plot 3 - Near Dam Site area-Uruliya, GPS Points-N 08°54.043' E 077°10.689'. The areas of planting were marked using paints for monitoring.

Field trips are made to Bonacaud and Chemunji areas for collecting the fruits of *Garcinia imberti* and *Betinckia condappana*. As these two species are endemic to Southern Western Ghats and IUCN red listed, conservation measures are necessary for the future survival of the species.

### **Nutritional analysis and development of nutraceuticals/ food supplements based on 'Arogyapacha' (*Trichopus zeylanicus* subsp. *travancoricus* Burkill ex K. Narayanan): an ethnomedically important plant**

Population structure and dynamics of *Trichopus zeylanicus* subsp. *travancoricus* were studied. Observed eco-physiological and edaphic parameters in *in-situ* variables prevailing along with the elevation range of 100-1000 m asl. These factors are playing key role in the growth, reproduction, and distribution of the species. Significant annual variations were noted in population size and percentage of species existence with respect to natural stochastic disturbances. The age distribution pattern of the species revealed that seedling, sapling, and

mature individuals significantly varied among populations. The reproductively able groups of plants along with good rate of seedlings were identified in Kulathupuzha and Aryankavu forests. Field observations in Bonacaard, Kallar, Kottur, Neyyar and Cheenikkala forest patches and particularly of Kulathupuzha forest range revealed less content of phosphorous and more zinc in rhizosphere favoured mycorrhizal fungi association which enhanced plant growth. In the light of these observations, Kulathupuzha population were selected as the elite population for nutritional analysis. Detailed nutritional analyses identified that the plant has potent nutritional value. The analysis revealed that the energy sources like carbohydrate, crude fibre, vitamins B1, B2, B3, B6 and C are remarkably high in quantity. The plant also contains phosphorous, calcium, zinc, manganese, iron and sodium. Based on these results, development of nutritional supplement is in progress.

### **Conservation of Vulnerable sandalwood (*Santalum album* L.) through propagation and reintroduction**

*Santalum album* is the second most expensive wood in the world (Rs. 300,000/kg). It is included under 'Vulnerable' category as per IUCN Red List (IUCN 2018). The project aims to work on the seed storage and germination for raising quality planting material of *Santalum album* and transplant these seedlings to the natural habitat.

Seeds pre-treated with GA3 500 ppm overcame seed dormancy and germinated faster with high germination percentage. Irrespective of treatments, room temperature (30±2°C) was the best condition for sandal seed germination. So, GA3 500 ppm pre-treated seeds placed in petri dishes lined with Whatman no. 1 filter paper at room temperature (30±2°C) were observed as the best condition for the seed germination. Potting media containing soil, sand, and cow dung in 1:1:1 ratio was the best medium for propagation. *Cajanus cajan* or *Crotalaria retusa* were found to be the best host plants for the seedling growth and development. Conservatory shed is the better condition for keeping the transplanted seedlings.

### **Study on ecology conservation and utilization of *Diospyros crumenata* Thw. in Kerala - an endangered tree of Western Ghats**

Population survey of *Diospyros crumenata* was continued in the Kerala region of the Western Ghats. During this period, populations were surveyed at Peruvannamuzhi forest (Calicut Division), Kakkayam forests (Malabar WLS) and Achenkovil forests (Kollam District). So far, three populations of the species were identified which are in Thrissur District viz.

Vazhachal/ Poringalkuth (Vazhachal Forest Range/ Vazhachal Division), Chakkapara and Vellani Mala (Pattikad Forest Range/ Thrissur Division). Population details *viz.* GPS coordinates, number of mature individuals, area of occupancy, extent of occurrence, natural regeneration, habitat threats *etc.* were collected from each site.

The Extent of Occurrence and Area of Occupancy of the species in Kerala were calculated as per IUCN criteria (Geo Cat app.). The extent of occurrence was observed as 228.072 km<sup>2</sup>, the Area of Occupancy as 36.000 km<sup>2</sup> and number of mature individuals was less than 100.

**Population structure:** Study of population structure was already completed within sampled and non-sampled areas at three population sites by recording GBH, basal area, basal cover, age phase and height of each individual@  $\geq 30$  cm.

**Population diversity:** Population diversity analysis at three population areas was completed. Five quadrates (50m $\times$ 20m each) were selected at each site and all the individuals  $\geq 30$  cm were enumerated in terms of relative frequency, relative density, relative dominance, and Importance Value Index (IVI). The IVI of each species was worked out and relative dominance/ abundance were calculated.

The ripe fruits of *D. crumenata* were collected from the population located in Poringalkuth forests for nutritional analysis. The nutritional elements such as Total Mineral Contents (%), Carbohydrate (g/100g), Protein (g/100g), Total sugars (%), Ascorbic Acid (mg/100g), Sodium (mg/100g) and Potassium (mg/100g) were evaluated as per the methods suggested (Sadasivan and Manickam, 2009). The ripe fruits of the species were rich in nutritional elements. The elements identified were compared and were found more promising than other cultivated fruits. The Total Mineral Contents, Total sugars, Ascorbic Acid and Sodium were higher than the ripe jack fruits. The elements such as Protein, Sodium and Potassium were higher than those of ripe mango fruits. The protein content was higher than the ripe Pineapple fruits.

### **Regulation mechanism of seed germination in selected species of *Myristica* Gronov. (Myristicaceae) in Kerala**

*Myristica malabarica* Lam., *M. magnifica* Bedd. and *M. beddomei* King of the family Myristicaceae faces severe threats in their natural habitats, particularly of the Western Ghat's evergreen forests and *Myristica* swamps. Human activities, climate change, invasive alien

plants and over exploitation for medicinal purposes pose substantial risks to their survival. Poor regeneration of their recalcitrant seeds also gives way to their endangered status. To address this challenge, a comprehensive study was focused on the genus *Myristica* as a model to unravel the mechanisms of seed recalcitrance. This understanding becomes crucial for devising effective conservation strategies to prevent their extinction. Seeds of the four *Myristica* species, including that of the cultivated *M. fragrans* Houtt. revealed high moisture content during shedding which is typical to recalcitrant seeds. Notably, though the small embryo and comparatively large ruminant endosperm coexist and contribute optimal moisture and nutrient levels, viability loss occurs when desiccated due to the absence of natural protective mechanisms. The critical moisture content (CMC) of each species was identified below which viability was significantly decreased. Desiccation-induced loss of viability was further confirmed through electrolyte and solute leakage measurements and the formation of triphenyl formazan in embryonic tissues.

The developmental changes in *Myristica* seeds including *M. malabarica*, *M. magnifica*, *M. beddomei*, and *M. fragrans* reveal dynamic biomolecular shifts. The embryo predominantly comprises proteins, amino acids, and soluble sugars for fuelling germination. Elevated starch and lipid levels in the endosperm support energy demands during maturation. Desiccation amplifies starch and lipid concentrations, indicating heightened metabolic activity. Total soluble sugars in the embryo decrease due to dehydration, while free amino acids, notably proline accumulate as abiotic stress protectants. Phenolic compounds increase under water stress, benefiting both endosperm and embryo, but insufficient phenol-protein aggregates in the embryonic tissues lead to diminished seed viability.

The dynamics of plant growth regulators (PGRs) during the seed lifecycle in *Myristica* species revealed distinct patterns. In late embryogeny, low concentrations of auxins, gibberellins, and cytokinins were observed, contrasting with notably higher levels of abscisic acid (ABA). As germination initiated, there was a significant rise in auxins, gibberellins, and cytokinins, accompanied by a decrease in ABA and salicylic acid (SA), indicating the need for a balance between these antagonistic PGRs for successful seed germination. Pre-sowing treatments with PGRs like IAA, GA<sub>4</sub> and Panchagavya enhanced seed germination metrics, while ABA exhibited an adverse effect. Such insights guided for opting recommended approach in augmenting seed germination and seedling growth of *Myristica* species.

Due to their recalcitrant nature, the seeds of *Myristica* species quickly lose their ability to germinate shortly after being shed. The seeds are particularly sensitive to desiccation and exposure to colder temperatures, making it challenging to store them for extended durations. However, it is possible to prolong the viability period by maintaining optimal storage conditions as exemplified in the case of *M. malabarica* seeds stored as long as 90 days at  $18 \pm 2^\circ \text{C}$  and a relative humidity of  $50 \pm 2\%$ .

Scientific validation of traditional knowledge related to seed sorting in the Palakkad District confirmed the efficacy of three sayings: "*Parum vithu mulakilla*" (Floating seeds fail to sprout), "*Kulungum vithu mulakilla*" (Shaky seeds fail to sprout), and "*Vilartha vithu mulakilla*" (Seeds pale with coloured seed coat fail to sprout). Observations substantiated those viable seeds exhibited deeper grooves on their seed coat surface, while non-viable seeds display shallow grooves, in line with the traditional knowledge practices of agricultural communities.

Comprehensive investigations on various aspect of *Myristica* seed biology, including development, maturation, desiccation, germination, changes in plant growth regulators, biomolecules and cellular membrane integrity contributes significantly to our understanding of tropical seeds, especially recalcitrant ones. Ultimately, these research findings advance our knowledge on endangered *Myristica* species and aid in formulating measures to ensure long-term species survival through seed-oriented conservation strategies.

### **Seed Physiological studies of *Bentinckia condapanna* Berry ex Roxb., a rare endemic tree palm of Southern Western Ghats**

Seed germination of *Bentinckia condapanna* was studied extensively for ensuring the restoration and conservation of this ecologically significant red listed species. Physiologically mature- 12 MAA pyrenes were used for the germination study. The hard endocarp and seed coat of the pyrene extended impermeability to water. The control pyrenes exhibited 20% germination with the germination period spanning from 2 to 8 months. The germination pattern exhibited is hypogeal and adjacent ligular. A small portion of the cotyledon emerges from the pyrene as a button-like structure subtending the plumular and radicular axis from the top and bottom of the button respectively. The pyrenes remain horizontal, neither above nor below the plumular-radicular node. The admotiveligular germination pattern indicates that *B. condapanna* might belong to the phylogenetically advanced members among the Arecaceae (Saakov, 1954). Even though the radicular and plumular propagule initiated to emerge

simultaneously, the first to emerge out physically was the radicle with the primary root. This was followed by the ligule emergence from the plumular axis. The primary roots soon got replaced by adventitious roots at the plumular-radicular node and later developed secondary roots on the adventitious roots. Three ligules emerge prior to eophyll emission.

Among the various priming studies conducted, scarification yielded the better result. But removing the endocarp lid and operculum of the seed coat exposing embryo and endosperm lead to either decay of the endosperm and embryo or deformed the button which delayed plumular-radicular emergence. Removing the endocarp lid and carefully thinning the operculum without removing the structure accelerated the germination speed and germination percentage. This proves the hindrance extended by envelopes of the pyrene on its germination. The then comparable result was yielded by least concentration of gibberellic acid (100 ppm) for 48 hours. Hence, the scarification protocol could be employed while raising seedling for restoration purposes.

To check whether the absence of Dehusking agents of the pyrene in the natural habitat could have any impact on the germination, allelopathic impact of pericarp on germination was checked. Seeds with pericarp yielded germination which indicates the absence of allelopathic impact of pericarp on seed germination.

Wet storage of pyrenes under room temperature in closed Ziplock bags (filling only 25% volume of the bags and the rest inflated with air) was found to be the best storage protocol to store the viable propagules for a minimum period of 8 months. The results obtained during the germination and storage studies could be extensively used while generating large number of seedlings for restoration purposes in the future endeavours.

### **Reproductive biology of *Goniothalamus keralensis* E.S.S. Kumar *et al.***

*Goniothalamus keralensis* is an endemic species of Annonaceae family. It is restricted to three sites of Idukki District and survived with less than 200 plants. It is a wild relative of medicinally important *Goniothalamus* species. During the period under report, we studied the population structure and seed dispersal and germination studies. Population of this species is found in Valara and Mankulam. The habit analysis showed that they are growing adjacent to rivers and rivulets. The plants are shrubby nature attaining a height of 5 meters. The population at Valara is spread in area of 7 square kilometre and found as three sub population. The subpopulation 1 was near a rivulet with 9 adult plants and three seedlings/ saplings.

Major tree associates were *Vateria indica*, *Elaeocarpus* sp. and *Leea* sp. The second subpopulation was composed of 14 adult individuals and 11 saplings spread on two sides of the rivulet. The major associate was *Humboldtia vahliana* and *Ochlandra travancorica*. The third subpopulation was larger one with more than 25 adult plants and 18 saplings. In this area, the major associates were *Vateria indica*, *Humboldtia vahliana* and *Ochlandra travancorica*, *Zingiber* sp. at Mankulam, only a single large population was found near the river. It consisted of more than 50 adult plants and 21 saplings. Flower buds initiated in mid-October and continued up to January. A flower bud took about 45 to 50 days to become a flower. Fruit set was recorded from December to April. Fruits were berry and were green, which changed to orange on ripening. Each fruit contained a single seed. Seed dispersal was mainly carried out by water. Seeds took 46 days for germination in the normal condition. Further studies are progressing.

#### **Systematics and conservation of natural populations of *Phyllanthus emblica* L. (Amla) in the southern Western Ghats**

The Indian gooseberry or amla (*Phyllanthus emblica* L.) has several culinary and medicinal uses. They are the treasure trove of ascorbic acid - the vitamin C. Naturally there are different variants, differ in terms of taste, size, colour differences, and texture of flesh. Even though, we use many hybrid varieties for culinary purpose, traditional medicinal sector rely heavily on our wild fruits. Due to habitat destruction coupled with over exploitation in an unscientific manner, this highly sought medicinal tree is facing a constant threat of extinction. The present research programme aims to characterize different forms of Indian gooseberry growing naturally in the southern Western Ghats through morphological, phytochemical and molecular techniques and to find plus trees and their conservation and popularisation. Samples of leaves from these accessions were also collected for molecular characterisation. Details such as size of fruit, colour, weight, number of fruits in one kilogram were recorded, following standard methods, for calculating average fruit production, taste, moisture content and total soluble sugar concentration. Further collection of samples and chemical characterisation such as determination of lipid, protein, vitamin content *etc* are in progress.

#### **Propagation and conservation of selected *Garcinia* species**

*Garcinia*, belongs to the family Clusiaceae, has 250 species distributed globally. It is the largest genus of the Clusiaceae, usually found in evergreen to semi-evergreen forest of

tropical and sub-tropical region. In India the genus is represented by 43 species and 5 varieties, among them 38 species are found in the wild and rests are introduced. The Western Ghats hold nine species, two varieties and four of them are endemic to Agasthyamala biosphere reserve. These species have been placed under different categories in the IUCN Red List of Threatened species. Present project targets to conduct field surveys to identify populations of *Garcinia* species, study their phenology, develop propagation methods and conservation strategies.

To identify population of *Garcinia gamblei*, surveys were conducted in forest areas of Kerala part of the Western Ghats. The species was found in Ponmudi hills, the only known locality of the species, in Thiruvananthapuram District of Kerala. We located 31 trees within an area of <1 Km<sup>2</sup>, with girths of 20-150 cm at breast height. Only three female and one male tree was located at an altitude of 964-1097 m. The trees produce small number of flowers during November to February and fruiting is observed during June to September. Some potential threat to this species is low number of reproductively active trees, rarity of seedlings, increased number of tourists and occasional forest fires and high seed predation.

## **DIVISION OF PHYTOCHEMISTRY AND PHYTOPHARMACOLOGY**

The main mandate of the Phytochemistry and Phytopharmacology Division of JNTBGRI is to carry out chemical and pharmacological studies of potential medicinal and aromatic plants.

### **Areas of Research**

- Phytochemistry, new molecules, biological activities
- Essential oils, chemical profiling, biological activities
- Search for elite lines of medicinal plants
- Secondary metabolite-based nanoparticles, their biology
- Chemical ecology
- Chemical profiling of fats and oils

## **Important achievements**

### **Establishment of Centre of Excellence in Phytochemical-Nanotechnology at KSCSTE-JNTBGRI under SHRESTA**

Excellence in Phytochemical-Nanotechnology is a niche area in the advanced nanotechnology where great attention is needed for the development of useful products to the society as well as to create scientifically trained manpower in the concerned area of nanotechnology for the development of our State/ Nation. In phase one (1 and 2 years) and Phase II (3,4 and 5th years) deliverables like wound healing phytochemical embedded nanopads and nano encapsulated essential oil for food grain pest management are envisaged. In human resource development the programme envisages training to researchers, industrial collaborations, collaborations with national and international R & D centres (in I and II phases, SCTIMST Thiruvananthapuram is the national collaborator and University of Oklahoma Health Science Centre, Oklahoma City, USA is the international collaborator). The CEP also provides a platform for researchers and industries for the onsite synthesis of nanomaterial from phytochemicals. The patents and training fee, royalties are focused in the II phase of the programme, which will enhance the CEP as a self-sustainable entity.

### **Prey capture mechanism in *Nepenthes***

We recently discovered growing *Nepenthes* pitchers as carbon dioxide (CO<sub>2</sub>)-enriched cavities, holding nearly ten times ( $\approx$  4000 ppm) the atmospheric level of the greenhouse gas within them. Open pitchers emit CO<sub>2</sub> as a cue attracting preys towards them. In this study, we demonstrate that the most critical features of *Nepenthes* prey traps such as their growth, metabolism, prey capture, digestion and herbivory are driven by the CO<sub>2</sub> within them. *Nepenthes* pitchers are classic examples of leaf-evolved structures displaying manifestations of elevated CO<sub>2</sub> within them. Further, we showed that extrafloral nectar (EFN) secreted by *Nepenthes* pitchers, long regarded as the nutritional ‘reward’ to the visiting arthropods, is a carbohydrate-rich secretion devoid of key nitrogenous constituents such as amino acids, proteins (low) and vitamin C. Moreover, *Nepenthes* EFN and its constituent, (+)-isoshinanolone, displayed strong inhibition of acetylcholinesterase (AChE) *in vivo* and *in vitro*. This AChE inhibitor is a promising insecticidal entity and a likely candidate for Alzheimer’s disease therapy. We testify that *Nepenthes* EFN is ‘a toxic sugar bait’ which hinders neuronal activity and flight of the visiting arthropods. In fact, *Nepenthes* EFN plays the dual role of a lure and a toxin. These unique traps adopt various deceptive strategies for

prey capture, and our discovery eliminates the notion that *Nepenthes* EFN is a ‘reward’ to visiting ants and other arthropods. [‘Toxic bait’ from Indian pitcher plants lures hungry insects to their doom. *Science News* 2023. doi: 10.1126/science. zzb21md]

### **Ethyl palmitate, an anti-chikungunya virus principle from *Sauropus androgynus*, a medicinal plant used to alleviate fever in ethnomedicine**

*Sauropus androgynus* is a medicinal shrub used for the treatment of fever in ethnomedical traditions in various Southeast Asian countries. This study was aimed to identify antiviral principles from *S. androgynus* against Chikungunya virus (CHIKV), a major mosquito-borne pathogen that re-emerged in the last decade, and to unravel their mechanism of action. Hydroalcoholic extract of *S. androgynus* leaves was screened for anti-CHIKV activity using cytopathic effect (CPE) reduction assay. The extract was subjected to activity guided isolation and the resultant pure molecule was characterized by GC-MS, Co-GC and Co-HPTLC. The isolated molecule was further evaluated for its effect by plaque reduction assay, Western blot and immunofluorescence assays. *In silico* docking with CHIKV envelope proteins and molecular dynamics simulation (MD) analyses were used to elucidate its possible mechanism of action. *S. androgynus* hydroalcoholic extract showed promising anti-CHIKV activity and its active component, obtained by activity guided isolation, was identified as ethyl palmitate (EP), a fatty acid ester. At 1 µg/mL, EP led to 100% inhibition of CPE and a significant 3-log<sub>10</sub> reduction in CHIKV replication in Vero cells at 48 h post infection. EP was highly potent with an EC<sub>50</sub> of 0.0019 µg/mL (0.0068 µM) and a very high selectivity index. EP treatment significantly reduced viral protein expression, and time of addition studies revealed that it acts at the stage of viral entry. A strong binding to the viral envelope protein E1 homotrimer during entry, thus preventing viral fusion, was identified as a possible mechanism by which EP imparts its antiviral effect. *S. androgynus* contains EP as a potent antiviral principle against CHIKV. This justifies the use of the plant against febrile infections, possibly caused by viruses, in various ethnomedical systems. Our results also prompt more studies on fatty acids and their derivatives against viral diseases.

### ***Elettaria cardamomum* leaves, an underutilized resource: Chemical profile of its essential oil and insecticidal activity**

*Elettaria cardamomum* is known as the ‘Queen of spices’; its leaf essential oil (EO) is least investigated and barely utilized. Here we report the chemical composition of *E. cardamomum* leaf EOs collected from five locations in the southern Western Ghats in India. EOs of fresh

and dry capsules were also analyzed for comparison of their chemical profiles. The major constituents in cardamom leaf EOs were  $\beta$ -pinene (35.6-51.9%) and coronarin E (17.7-34.2%). In fumigant toxicity assays against two stored product pests, lowest LC<sub>50</sub> against *Tribolium castaneum* was recorded in EO of fresh capsules (124.05  $\mu$ L/L), followed by dry capsules (LC<sub>50</sub> 128.21  $\mu$ L/L) and leaves (LC<sub>50</sub> 148.00  $\mu$ L/L); LC<sub>50</sub>s of fresh, dry capsule and leaf EOs against *Sitophilus oryzae* were 30.24, 35.33 and 89.42  $\mu$ L/L, respectively. This study demonstrates cardamom leaves as a source of untapped bioactive principles which can be viably utilized to produce botanical pesticides.



*Elettaria cardamomum*: habit, flowers, fruits and seeds.

**Insecticidal properties of *Clausena austroindica* leaf essential oil and its major constituent, trans-anethole, against two stored product pests, *Sitophilus oryzae* and *Tribolium castaneum***

In this study, the chemical profile of the leaf essential oil of hitherto uninvestigated shrub *Clausena austroindica* B. C. Stone & K. K. N. Nair and its insecticidal potential against two stored product pests, *Sitophilus oryzae* (L.) and *Tribolium castaneum* (Herbst) are being investigated. Essential oils from the leaves of *C. austroindica* collected from two locations in south India were isolated by hydrodistillation and analyzed by gas chromatography-flame ionization detector (GC-FID) and gas chromatography-mass spectrometry (GC-MS). Six to eight compounds comprising 99.41-99.44% were characterized with trans-anethole (phenyl propanoid) as the major component (95.12-97.44%) in leaf essential oils. Trans-anethole was isolated from the leaf oil by column chromatography, characterized by Fourier Transform Infrared (FT-IR), ultraviolet-visible (UV-Vis), <sup>1</sup>H-, <sup>13</sup>C- and distortionless enhancement by polarization transfer (DEPT 135) nuclear magnetic resonance (NMR) spectroscopy, and quantified by external standardization. Insecticidal activity of *C. austroindica* leaf oil and trans-anethole were assessed against the rice weevil (*S. oryzae*) and red flour beetle (*T. castaneum*) by contact and fumigant toxicity assays. The mammalian cell toxicity of *C. austroindica* leaf oil and trans-anethole was also tested against L929 cell lines using (3-(4,5-dimethylthiazol-2-yl)-2,5-diphenyltetrazolium bromide) MTT assay and quantification of reactive oxygen species (ROS). *C. austroindica* leaf oil and trans-anethole demonstrated superior contact and fumigant toxicities against adult beetles of *S. oryzae* and *T. castaneum*. *C. austroindica* leaf oil and trans-anethole showed potential fumigant toxicity against *S. oryzae* (lethal concentration 50 (LC50) 38.80 & 76.98 µL/L) and *T. castaneum* (LC50 35.65 & 29.10 µL/L). Relatively less prominent *viz.*, *S. oryzae*: LC50 leaf oil 469.70 µL/L, trans-anethole 2543.20 µL/L; *T. castaneum*: LC50 leaf oil, 1090.70 µL/L, trans-anethole 2050.84 µL/L, but significant contact toxicities were displayed by the leaf oil and trans-anethole against the two stored product pests. Both *C. austroindica* leaf oil and trans-anethole (< 2.0 µg/mL) have not demonstrated any mammalian cell (L929 cell line) toxicity. Our study demonstrates the potential *C. austroindica* leaf essential oil as a new botanical insecticide for controlling stored product pests. Its major component, trans-anethole, also showed prominent insecticidal activity.

## **Flower-fruit dynamics, visitor-predator patterns and chemical preferences in the tropical bamboo, *Melocanna baccifera***

Mast seeding and associated events in *Melocanna baccifera*, the largest fruit producing bamboo, is an enigma. So far there are no comprehensive accounts on its flowering phenology, fruiting dynamics and animal interactions. In this study, spanning over 13 years (2009 to 2022), we observed eight *M. baccifera* clumps in JNTBGRI Bambusetum from flowering initiation, fruiting to eventual death. Flowering phenology, floral characteristics, floret types, breeding system, bee visitation, pollination, fruit production and predators were recorded; predation patterns were correlated with fruit chemistry. Flowering duration of clumps ranged from 20 (March 2009 - October 2010) to 120 (September 2012 - August 2022) months. Bisexual florets are dichogamous and protogynous; and female duration (22-72 h) is many times higher than male duration (2-6 h). The highest ever fruit production for an individual bamboo clump (456.67 Kg) was recorded. Of the total fallen fruits (38371), 38.11% were predated, 43.80% good fruits (no predator hits) and 18.09% immature fruits. A positive correlation between reward (fruits) *versus* predation was observed, especially in short intervals of high fruit production. Pollen predators (*Apis cerana indica*, *Halictus taprabonae*, *Brauns apiscupulifera*, *Trigona iridipennis*), fruit predators, ranging from arthropods to mammals, *viz.*, millipede (*Spinotarsus colosseus*), slug (*Mariaella dussumieri*), snails (*Cryptozonia bistrialis*, *Macrochlamys* sp.), borers (*Achroia grisella*, *Blattella germanica*), mammals (monkeys *Macaca radiata*, rats *Rattus rattus*, porcupine *Hystrix indica*, wild boar *Sus scrofa*, palm civet *Paradoxurus hermaphroditus*), seedling predators (rabbit *Lepus nigricollis*, deer *Axis axis*), and insect/ pest predators (ants *Crematogaster biroi*, *Oecophylla maragdina*, mantis *Euchomenella indica*) were identified. Fruit predation is linked to its age and chemistry. Apart from new insights on flowering phenology, breeding system, pollination and fruiting dynamics, this study demonstrates the vibrant interaction between *M. baccifera* flowers/ fruits and visitors/ predators and provides significant leads towards elucidating the cause of rat multiplication and other events associated with its gregarious flowering.

## **Head Space volatile chemical profiling of Plants at JNTBGRI**

Compilation of the headspace volatiles of 100 flowers from JNTBGRI plants in book form is in final stage.

## **Development of Tropical Soil Scent**

The smell of fresh rain has been recreated from plant derived volatile organic compounds and introduced as 'tropical soil scent' in the Global Science Fest-2024, held at Thonnakkal, Thiruvananthapuram.

## **Phytochemical profiling of selected *Agaricus* species**

*Agaricus* mushrooms are considered as nutraceuticals and functional foods. In the present study the essential fatty acids such as linoleic acid ( $\omega$ -6 PUFA), eicosadienoic acid ( $\omega$ -6 PUFA), linoelaidic acid ( $\omega$ -6 TFA) and others like palmitoleic acid ( $\omega$ -7 MUFA), oleic acid ( $\omega$ -9 MUFA) were found in the mushroom species. The headspace volatile profiling of selected *Agaricus* species have identified isovaleraldehyde, butyraldehyde, toluene, 2,3-butanediol, benzaldehyde and 2- heptanone as the characteristic flavor and aroma compounds.

## **DIVISION OF PLANT SYSTEMATICS AND EVOLUTIONARY SCIENCE**

The research activities of Plant Systematics and Evolutionary Science Division mainly focuses on themes such as (i) Taxonomic studies, herbarium management and development, ecosystem assessment, rescue and restoration of RET species. The Division is also devoted to the plant systematics in the broadest sense, encompassing phylogenetic, evolutionary and biogeographical studies at the family, population, specific and higher taxonomic levels. Exploration trips were carried out for the documentation of the plant resources of the state which include species of economically important genus *Cinnamomum*, *Sonerila*, ornamentally potential climbers and species of the family Annonaceae. Attention was also paid to enumerate the floristic richness of laterites with emphasis on endemics and threat category species. Upkeep and maintenance of *Myristica* swamps also have been undertaken due to its importance in protecting water regime and ecology of the area. Upkeep and development of a field gene bank of 126 local mango varieties in the campus ensuring its conservation and base resource for further breeding programmes. The herbarium TBGT is the inevitable part of the division which holds 45416 specimens, 3832 species under 1432 genera.

## **Inventory Systematics and Conservation of family Annonaceae of Southern Western Ghats with emphasis on Endemic, RET species**

### **Establishment of Custard Apple Park**

Annonaceae is of considerable economic importance throughout the tropics of the world as a source of edible fruits. Locally called as Aathaka, a delicious fruit to enrich the fruit basket. In tropical region, large fleshy fruits of various species of *Annona* viz. *A. muricata* (Sour soup), *A. squamosa* (Sweet soup, Custard apple, Sugar apple, Sitaphal) *A. reticulata* (Bullock's Heart, West Indian Custard apple) are juicy and edible. Soursoup is cultivated widely for its fruits which yield a sap used as beverage and in the preparation of jellies and the juice pulp is used for dessert. *Polyalthia longifolia* is planted as ornamental especially for its fine foliage which gives a natural fencing. *Cananga odorata* has fragrant flowers used for the preparation of a perfume ylang-ylang.

Extensive forest explorations in Western Ghats of Kerala lead to the information on new ecological locations of 3 plant species *Goniothalamus keralensis*, from Ilaiveezha poonchira, Kottayam, *Polyalthia shendurunii*, from Chemunji, Bonaccord, *Goniothalamus wynaadensis* from Thommankuthu, Idukki. In this *Polyalthia shendurunii* is IUCN endangered category species. Herbarium addition, seed germination studies and *ex-situ* conservation of species are important aspects of this project. Seed germination studies of *Polyalthia shendurunii* has been conducted with various Moisture Content (MC) ratios. Based on germination studies *Polyalthia shendurunii* shows nature of recalcitrant type of seed. So *ex-situ* conservation is an important aspect for its protection. More than 35 saplings were conserved in PSES custard apple garden. Besides this, germination studies of *Artabotrys zeylanicus* var. *kottavasaliyana*, *Uvaria narum*, *Meiogyne pannosa* were conducted. *Goniothalamus wightii* and *Artabotrys zeylanicus* var. *kottavasaliyana* are the 2 new species added to the custard apple garden. Layering of a variegated variety of *Artabotrys zeylanicus* has been carried out which have ornamental value.

### **Inventory, Systematics and Conservation of *Ixora* L. (Rubiaceae) of Kerala**

The genus *Ixora* L. of the family Rubiaceae is one of the wild ornamentally potential groups among flowering plants and forms an integral part of any garden landscape. *Ixora* is a part of any garden landscape from time immemorial. It is popularly called as West Indian Jasmine, Flame of the woods, Jungle geranium. It comprises of about 400 species and largely

pantropical in distribution with the greatest diversity of species occurring in the SE Asian region. *Ixora* species are well known for their ornamental potential and forms an integral part of any garden. Due to their peculiar floral attraction and habits, they can be easily recognised by a common man. With their fine foliage and curious and variously coloured flowers, cultivars are preferred for topiaries, borders, green fencing *etc.* Flowers are numerous and showy and possess horticultural potential. They are also attractive to butterflies making the garden most attractive. All these attributes for its preferential selection during the designing of a garden. *Ixora coccinea* is widely distributed and enrich open landscapes adjacent to forests with its red coloured blossoms.

In India, about 51 species occur and chiefly confined to mountains regions of Himalayas, hills of Northeastern states and Western Ghats. In Peninsular India 11 species are so far reported. In India there are about 51 species of which W. Ghats inhabits 19 with 9 endemics. There are 18 species in Kerala with 6 endemics, *Ixora acuminata*, *I. agasthyamalayana*, *I. johnsonii*, *I. notoniana*, *I. thwaitesii* and *I. undulata*. There are 3 species falling under IUCN category.

Altogether, 28 plant collection trips were conducted mainly in the Southern districts of Kerala and 864 propagules were collected for propagation. During the reporting period, we have documented fourteen species of *Ixora* viz. *Ixora agasthyamalayana*, *I. brachiata*, *I. coccinea*, *I. cuneifolia*, *I. elongata*, *I. gamblei*, *I. johnsonii*, *I. lavanya*, *I. malabarica*, *I. nigricans*, *I. notoniana*, *I. pavetta*, *I. polyantha*, *I. ravikumarii*, and collected available fruits, stem cuttings, root cuttings and herbarium specimens. Collected specimens were processed for herbarium as per standard procedures. These are economically important species other than ornamental value. *Ixora coccinea* is medicinally used as a curative of diarrhoea, dysentery, leucorrhoea with astringent and the report from Idukki describes, *I. brachiata* is used to cure skin diseases.

### **Survey and Documentation of Folk Uses of Plants by the Kani tribes of Kerala part of Agasthyamala Biosphere Reserve with emphasis on NWFP based sustainable livelihood aspects**

The collection of NWFPs offers valuable self-employment opportunities, and historically, they have been responsible for generating over half of the forestry sector's jobs. This one-year study delves into the traditional knowledge of the Kani tribe regarding folklore plants and examines the trade of NWFPs within the Agasthyamala Biosphere Reserve. The Agasthyamala Biosphere Reserve has served as the traditional home of the Kanikkar tribe for

centuries. Recognized as the guardians of these forests until the pre-independence era, their traditional right to collect NWFPs was long unchallenged. The Kanikkar tribe is effectively adapting to the modern world while preserving their valuable traditional skills in areas such as medicinal plant knowledge, taxonomy, sustainable forest resource utilization, and conservation practices. These skills are invaluable for the effective management of the region's forests. Fostering pride in their heritage, encouraging self-assertion, and providing access to education and economic incentives can empower the Kanikkar tribe and enhance their social and economic standing.

Tribal communities, due to their deep-rooted connection with nature, possess a wealth of knowledge about folk plants. This study documented 168 plant species belonging to 71 genera and 56 families, including 70 herbs, 24 climbers, 36 shrubs, and 39 trees.

As the habitat for numerous rare and endangered flora and fauna, and a crucial source of valuable medicinal plants, the Agasthyamala Biosphere Reserve demands strict regulations to control human access. These regulations must effectively ensure the sustainable extraction of resources while preventing any form of illegal intrusion. The current one-year study provides a preliminary understanding of the NWFP trade within the reserve, but a longer-term investigation is necessary to gain a comprehensive grasp of the various factors influencing the outflow of NWFPs from the sanctuary, such as climate, market demand and price fluctuations.

Traditionally, forest wealth has been primarily assessed based on timber value. However, a global shift in forest management perspectives has emphasized the importance of alternative income generation sources, particularly NWFPs. While the exploration, extraction, and commercialization of these bio-resources offer economic opportunities, they also pose significant challenges to sustainable forest management. NWFPs are intricately linked to the ecological balance, economic well-being, and social structures of rural Kerala. Furthermore, each species exhibits unique requirements for reproduction, recruitment, and population growth, necessitating the implementation of scientifically sound harvesting practices. Given the scarcity of available data, this study assumes significant importance in guiding future research and management strategies.

The Government of Kerala, in recognition of the socio-economic needs of the Scheduled Castes (SC) and Scheduled Tribes (ST) communities, currently allows SC/ST

societies to collect 135 items of NWFPs free of cost as a welfare measure. However, despite this initiative, challenges persist in the proper harvesting, storage, and processing of NWFPs.

The current study underscores the significant contribution of NWFP species to the structure and functioning of forest ecosystems, demonstrating a mutually beneficial relationship. These natural resources play a vital role in the socio-economic landscape of Kerala. Research findings reveal that while many species thrive in abundance despite current harvesting practices, some are at risk of extinction due to unscientific methods and overexploitation. Therefore, this study aims to contribute to achieving the dual objectives of meeting the ecological and human needs of NWFPs while ensuring their long-term sustainable conservation.

### **Reverse The Red: Assessing the population trends and developing a Recovery programme for two *Cinnamomum* species Endemic to the Western Ghats**

This programme is funded by BGCI under Small Grants Programme. The study aims to describe and document the current population of the selected species, its habitat and any plausible threats to the known population, to serve as the basis for monitoring and formulating measures to protect the population. Under this programme, 5 field trips were conducted to selected study sites across the natural range of both species in Kerala and Tamil Nadu. Each site was surveyed during different seasons to capture variations in species population dynamics and to know the population structure. Propagation experiments of *Cinnamomum wightii* and *C. chemungianum* were carried out to raise requisite germplasm meant for *ex-situ* conservation. Propagation through air-layering was tried for multiplication with shoots of different types, such as tender, semi-hard and hard with auxin under different concentrations. Promising results have been achieved in both the candidate species by giving success with 70% rooting response. The rooted cuttings were detached from the mother plant and on acclimatization showing good survival rates. Final report has been submitted to BGCI.

### **Studies on the molecular systematics of the genus *Miliusa* in India.**

As part of the studies on the genus *Miliusa*, we have collected *Milius sahyadrica*, *M. nilagirica*, *M. wayanadica*, *M. agasthyamalayana*, *M. tomentosa*, *M. indica* etc. As part of the study, we have visited various herbariums such as MSSRF, Wayanad, KFRI, Thrissur, and MH, BSI, Southern circle, Coimbatore. Collected fruiting and flowering twigs for morpho-taxonomic studies. Specimens were deposited as voucher. Sampled young leaves to extract DNA for subsequent molecular phylogenetic studies.

Molecular study is crucial for deciphering the evolutionary relationship between taxa. As part of molecular phylogenetic study, leaves samples collected from field were subjected to DNA extraction using CTAB protocol, and performed PCR amplification using appropriate primers. Amplicons were sequenced at BioKart, Bangalore. Sequence data generated were edited and trimmed to remove their ambiguous bases and poorly aligned region, respectively, and subsequently aligned in MEGA. Phylogenetic inferences were derived from phylogenetic tree reconstructed in Mr Bayes software.

### **Vegetational and Ecological Assessment of Lateritic Zones of Northern Kerala: Endemism, Phytogeography, Evolution and Adaptive traits**

- 1) During this period Final Technical report of the Plan project entitled *Vegetational and Ecological Assessment of Lateritic Zones of Northern Kerala: Endemism, Phytogeography, Evolution and Adaptive traits* preparing and progressing the preparation of a book based on *Endemism, Phytogeography, Evolution and Adaptive traits*.
- 2) Conducted 6 exploration trips to different lateritic areas of Malappuram, Kozhikode, Kannur and Kasaragode Districts resulted the collection of 43 endemic taxa in which 2 species are new records for Kerala namely *Eriocaulon hamiltonianum* Martius. (Eriocaulaceae) & *Lepturus radicans* (Steud.) A. Camus (Poaceae) and one recollection after 30 years from the type locality, *Ischaemum jayachandranii* Ansari *et al.*, an exclusive endemic to Kerala coming under IUCN Critically Endangered Category. *Syzygium chavaran* (Bourd.) Gamble, *Mammea suriga* (Buch. -Ham. ex Roxb.) Kosterm, *Poeciloneuron indicum* Bedd. are three phytogeographically and medicinally interesting IUCN categorised species and *Strychnos ignatia* Berg. (Loganiaceae) supposed to be a new report for India, were collected from the sacred groves of lateritic hillocks; 150 herbarium sheets were prepared to incorporate TBGT. Seeds, seedlings and saplings of 16 rare plant taxa including red list category spices were also collected from the micro-niches of these special habitats for *ex-situ* conservation programme (seed bank and field gene bank). Identified extended distribution of *Eriocaulon periyarensis* Sunil *et al.* an exclusive endemic species of Kerala, so far reported only from Periyar river basin of Ernakulam District, from Chittar riparian belt in JNTBGRI campus.

## Specialty Collections

- *Eriocaulon dalzellii* Korn. (Endemic - Eriocaulaceae)
- *Dioscorea kalkapershadii* Prain & Burkill (Endemic - Dioscoreaceae)
- *Ischaemum kasaragodensis* Dileep & G. G. Nair (Endemic - Poaceae)
- *Neanotis tubulosa* (G. Don) Mabb. (India, Sri Lanka - Rubiaceae)
- *Diospyros candolleana* Wight (Endemic - Ebenaceae)
- *Memecylon subcordatum* Cogn. (Endemic - Melastomataceae)
- *Habenaria longicorniculata* Graham (India, Sri Lanka - Orchidaceae)

Another important work progressed during this period was the data compilation of Fragile Ecosystems of Kerala, based on some case studies over a decade of intensive and extensive field work.

- **Riparian Ecosystem:** Achankovil river basin.
- **Wetlands:** Kuttanad- a below sea level farming system within Vembanad Lake, one of the Ramsar sites in Kerala, India.
- **Mangroves:** Puthuvypeen, Largest single stretch of mangrove vegetation in Kerala (101 ha), Vembanad wetland (Ramsar site), Ernakulam District.
- **Myristica swamp:** Kulathupuzha - southern Western Ghats region of Kerala.
- **Sacred groves:** Selected Sacred groves (Madayi Kavu, Vallikkattu Kavu, Eringol Kavu and Vandanam Kavu).

## Herbarium Management and Development

During the period under report 9 plant collection trips were conducted to different ecological settings of southern Western Ghats and collected 1298 specimens belonging to 364 species. All the specimens were processed as per standard procedure. Incorporation of 2011 sheets and digitalization of 4672 sheets were also done. Renovation and fumigation were also carried out as part of upkeep and management. The details are as follows.



Taxonomy Lab: Herbarium Consultation

Specimens as of March 2024	:	45416
Number of species	:	3832
Number of genera	:	1432
Species addition to herbarium	:	11
Authentication certificates issued	:	34
Service rendered for Reference	:	1165

### Conservatories

1. Custard apple Garden: A repository of the family Annonaceae of Western Ghats with 44 species.
2. Mango germplasm: A resource hub of 126 varieties of local native mango varieties of Kerala.
3. *Myristica* swamp in the campus.
4. Acanthaceae Garden: A repository of 40 species.

5. *Strobilanthes* Garden: A collection of 22 species.

### **Red Data Book of Kerala Plants**

The primary objective of this programme is to compile the threatened plant components to bring out the Rare Plant Register for the State of Kerala. The project is successful in identifying all the threatened species by going through all available literature and based on field surveys. The target species are recorded and the data processed opening chances and pointing necessities to afford some protection to the species until this uncertainty is resolved.

Among 4694 species of Angiosperms inhabiting in Kerala, 4050 species are indigenous, and 616 species are exotic, naturalized or cultivated. Out of the total floristic wealth of Kerala, 1226 Angiosperm species were evaluated following IUCN criteria, of which a total of 297 species are threatened with extinction, 37 species are Near Threatened, 36 species are Data Deficient and a great majority of them (856 species) falls in the Least Concern (LC) category. Among Bryophytes, Pteridophytes and Gymnosperms, out of a total of 47 species evaluated based on IUCN criteria, 8 species are counted in the Threatened category and the remaining 39 species are included either in the NT or LC categories. This Red List of threatened plants includes many endemic species exclusively distributed in the State. These findings would serve as the baseline for the development and implementation of suitable policies and actions to conserve the threatened species reported from the State of Kerala.

### **Conserving RET species/ KSBB funded (Kudumbasree Project)**

The project is an outcome and continuation of the previous project entitled “Preparation of Red Data Book and Assessment of Threatened species of Kerala (flora including Aquatic Species)” undertaken by JNTBGRI with financial support from The Kerala State Biodiversity Board. A total of 488 Kudumbasree workers belonging to two southern districts namely Thiruvananthapuram and Kollam were given training on the propagation and conservation of the RET species listed in the report. A total of 13 exercises were given for the trainees during the training program. It is a new way of *ex-situ* conservation with people participation, which is primarily aimed to make awareness to conserve, protect and propagate the Rare, Endangered and Threatened species. The project has provided a significant boost to the

conservation process at the local and regional levels, ensuring availability of these resources in the long run.

## **DIVISION OF ETHNOMEDICINE AND ETHNOPHARMACOLOGY**

The Division of Ethnopharmacology was established in the year 1992, with the mandate for conservation, preservation, sustainable utilization and bioprospecting of the rich traditional knowledge related to plants used for food and medicine of our country through systematic documentation, pre-clinical studies, molecular ethnopharmacological research to translate/ extend the outcome of the research into action for the benefit of the common people.

### **Areas of Research**

Systematic documentation of Traditional Knowledge (TK) and Bio-prospecting through Ethnopharmacological Research, which includes: Ethno-medico-botanical survey and systematic documentation of Traditional Knowledge related to plants used for food and medicine, Preparation of database on Ethnomedicine/ Traditional Knowledge associated with plants used for food and medicine, Protection of Traditional Knowledge under *Sui generis* system, Comparative studies of Ethno-medico-botanical data with Ayurvedic system of medicine for enriching Ayurvedic Pharmacopoeia, Selection of plants for detailed Ethnopharmacological and Phytochemical studies pre-clinical studies based on Molecular-Ethnopharmacological approach through activity guided fractionation and Phytochemical studies, Pharmacognostic studies of selected medicinal plants/ market samples of raw drugs, Integrated drug development programme, technology transfer and commercialization, Implementation of participatory programme on “Conservation and Sustainable utilization of Medicinal and Aromatic plants in tribal/ rural areas, “Herbs for All and Health for All” - Sustainable utilization of locally available medicinal and food plants resources for Primary Health Care, Publication of books on various awareness programmes related to biodiversity conservation and sustainable utilization of medicinal/ aromatic/ wild edible plants, Strengthening research in evaluation of quality, safety and efficacy of Ayurvedic/ herbal medicines/ nutraceuticals and Recognition of IPR through Access and Benefit Sharing.

As part of the external project entitled, “Systematic Documentation of Traditional Knowledge Related to Plants used for Food and AYUSH & Indigenous Medicine” funded by Ministry of AYUSH, Govt. of India sanctioned to Kerala State Council for Science

Technology and Environment, Govt. of Kerala, produced two documentary films in English of two episodes of 60 minutes duration titled, 'Traditional Knowledge and Folk Practices' covering 19 selected sequences and another documentary film of two-day training programme for AYUSH doctors titled 'Traditional and Folk Practices' held at KSCSTE - JNTBGRI on 18 -19 November 2021.

The Progress Report (hard copy) of the Second phase (December 2019 - November 2021) of the project, 'Systematic Documentation of Traditional Knowledge related to plants used for food, AYUSH and indigenous medicine', funded by the Ministry of AYUSH, Government of India was prepared covering all the approved deliverables by Dr. Vinodkumar T G Nair, PI assisted by Ms. Saranya Mol S T, JPF and printed in 3 volumes with 1477 pages. The Progress report with 11 enclosures/ documents including 2 copies of peer reviewed UGC approved biannual journal, *Journal of Traditional and Folk Practices* (Vol. 7 (1 & 2) & 8 (1) June 2020 and Vol. 8 (2) December 2020) were submitted to the Ministry of AYUSH, Government of India on 5 May 2023.

Dr. Vinodkumar T. G. Nair, Senior Scientist & PI, attended and presented a PPT before the Project Appraisal Committee (PAC) chaired by The Special Secretary, Ministry of AYUSH, Government of India about the status of the second phase of the ongoing CoE project, 'Systematic Documentation of Traditional Knowledge related to plants used for food, AYUSH and indigenous medicine', funded by the Ministry of AYUSH, Government of India. The meeting was held at AYUSH Bhawan, Ministry of AUSH, New Delhi on 13 June 2023. In the meeting, Utilization Certificate and Statement of Expenditure of the 2<sup>nd</sup> instalment of the project were also submitted.

**Systematic documentation and Bioprospecting of ethnomedically important medicinal plants on tribal/ traditional knowledge through molecular pharmacological approach (Plan Funded project)**

Kerala is rich in ethnobiology/ ethnobotany related knowledge, the reason for taking up such a project, the rich knowledge base (both tribal and coastal) which is undocumented systematically so far. Unfortunately, this priceless Traditional Knowledge transpired over generations is deteriorating rapidly due to various factors including modernization, urbanization, deforestation, changing social and economic standards of the tribal and coastal communities *etc.* Hence, the prime objective of this project is to immediately document the remaining traditional wisdom of particularly the elderly coastal and tribal communities of

Kerala which could provide leads for further research and development. *In vitro* pharmacological screening of selected medicinal plants/ nutraceuticals based on tribal/ traditional/ Ayurvedic knowledge. Pharmacognostical characterization of selected ethnomedicinal plants of Western Ghats to enrich Ayurvedic Pharmacopoeia of India. *In vivo* pharmacological screening of potent medicinal plants selected based on tribal/ traditional knowledge.

As part of the inhouse project, “Systematic documentation and bioprospecting of ethnomedicinally important medicinal plants based on tribal/ traditional knowledge through molecular pharmacological approach”, conducted field trips to the coastal areas of Veliyancode, Purathur, Mangalam and Vettom Gramapanchayats, Malappuram District from 20 - 29 December 2023 as part of the plan project. Interviewed 23 knowledge providers from the Mangalam and Vettom panchayaths and data decoding and analysis are under process. During the field trip to the forest areas of Chaliyar, Chungathara and Mampad Gramapanchayats, Malappuram District from 16 January 2024 to 25 January 2024 and interviewed 37 knowledge providers in total and collected information related to food & medicinal plants, tools, artefacts *etc.* Conducted a field trip to the coastal areas of Veliyancode and Purathur Gramapanchayats, Malappuram District from 30 January 2024 to 5 February 2024 and interviewed 15 knowledge providers in total and collected information related to food & medicinal plants, tools, artefacts *etc.* As part of the field trip conducted to the coastal areas of Nirmaruthur and Vallikkunnu Gramapanchayats and Ponnani and Parappanangadi Municipalities of Malappuram District from 11 March 2024 to 20 March 2024 in connection with data collection related to food & medicinal plants, tools, artefacts *etc.*, interviewed 42 knowledge providers in total and produced as well as directed two documentary films titled, “Whispers of Nature” and “Waves of Tradition” (English and Malayalam) of 2 hours 11 minutes and 1 hour 31 minutes duration respectively.

### **Important Studies**

1. *In-vivo*, anti-inflammatory models such as formalin induced paw oedema and carrageenan induced paw edema in wistar rats with various concentration of hydro ethanolic root extract of the coded plant (RN) against the standard drug Aspirin (300 mg/kg) were carried out. The results obtained significant level of protection in 600 mg/kg and 800 mg/kg extracts.

2. *In-vivo* acute toxicity study and analgesic activity such as hot plate and Acetic acid induced writhing in Swiss-albino mice were conducted and the results revealed that, the ethanolic plant extract of the coded plant SH is devoid of toxic effect and has significant analgesic potential in 150 mg/kg and 450 mg/kg in both experiments.

3. *In-vivo* obesity study is on progress with various concentration of hydro ethnaolic root extract of the coded plant RN in HFD fed obese Wistar rats against standard orlistat (30 mg/kg).

4. *In-vivo* wound healing study such as excision and incision model of wound healing was completed with different concentrations of the coded plant SB was completed against the standard povidone iodine oinment.

5. *In-vivo* platelet augmentation activity study in wistar rats with various concentration of hydro ethnaolic root extract of the coded plants (RN, SB and SH) against Cyclophosphamide. The results obtained significant level of protection at 800 mg/kg extracts in all plants.

### **Remarkable/ Outstanding achievements**

#### ***Sauropus androgynous*, a potential candidate from ethnomedical traditions to develop antiviral therapeutic strategies.**

The resurgence of chikungunyavirus (CHIKV) in many parts of the world is a significant public health concern. *Sauropus androgynus* (L.) Merr. belonging to the family Phyllanthaceae is a medicinal plant with multiple uses in traditional cuisines and ethnomedicinal preparation. As part of the DBT programme on Antivirals from Medicinal plants” hydroalcoholic extract of *Sauropus androgynus* (SA) was tested for *in vitro* antiviral screening via CPE reduction assay and was subjected to activity guided isolation. The isolated molecule was further evaluated for its effect by plaque reduction assay, Western blot and immunofluorescent assay, *in silico* docking and molecular dynamic simulation analysis. The hydroalcoholic extract of *S. androgynus* showed promising anti CHIKV activity and its active component obtained by activity guided isolation was identified as ethyl palmitate (EP), a fatty acid ester. EP was found to possess substantial activity causing more than 90% reduction in cytopathic effect induced by CHIKV virus thus justifying the use of *S. androgynus* against fever like symptoms in ethnomedical traditional system and a proven candidate to develop antiviral therapeutic strategies.

### ***Pellionia heyneana* Wedd. ameliorates myelosuppression in cyclophosphamide induced thrombocytopenia.**

*Pellionia heyneana* Wedd. (Urticaceae), locally known as Elavan is used by the *Cholanaikan* tribes in their traditional practices to increase general health, immunity and to treat various liver ailments. Ethnopharmacological evaluation of platelet augmentation activity of the plant in cyclophosphamide induced thrombocytopenic Wistar rats revealed that pre-treatment with *P. heyneana* leaf ethanolic extract (PHLE) significantly ameliorated the myelosuppression in cyclophosphamide induced thrombocytopenic rats by the significant ( $p \leq 0.05$ ) increase in RBCs, WBCs and platelet count compared to cyclophosphamide alone treated group. The significant decrease in clotting time, prothrombin times and activated partial thromboplastin time were observed in PHLE treated group compared to the toxin group also supports the platelet augmentation activity of *P. heyneana*. The reported hepatoprotective activity and the present finding on platelet augmentation activity of *P. heyneana* may together contribute towards the development of a potent drug for treating thrombocytopenia in chronic liver patients by stimulating platelet production *via*. targeting thrombopoietin (TPO) receptor mediated pathways.

### **Systematic documentation and Bioprospecting of ethnomedically important medicinal plants on tribal/ traditional knowledge**

- Conducted contact and awareness programmes at Chaliyar, Chungathara, Mampad, Niramathur and Vallikunnu Gramapanchayaths and Ponnani and Parappangadi Municipalities of Malappuram District.



Contact and awareness programme conducted at coastal Municipality, Ponnani, Malappuram district, Kerala.

- During the field trip to the forest areas of Chaliyar, Chungathara and Mampad Gramapanchayaths, Malappuram District from 16 to 25 January 2024 and interviewed 37 knowledge providers in total and collected information related to food & medicinal plants, tools, artefacts *etc.*



Contact and awareness programme conducted at tribal Gramapachayth, Chaliyar, Malappuram district, Kerala.

- Conducted a field trip to the coastal areas of Veliyancode and Purathur Gramapanchayaths, Malappuram District from 30 January 2024 to 05 February 2024 and interviewed 15 knowledge providers in total and collected information related to food & medicinal plants, tools, artefacts *etc.*
- As part of the field trip conducted to the coastal areas of Nirmaruthur and Vallikkunnu Gramapanchayaths and Ponnani and Parappanangadi Municipalities of Malappuram District from 11 March 2024 to 20 March 2024 in connection with data collection related to food & medicinal plants, tools, artefacts *etc.*, interviewed 42 knowledge providers in total.

## അന്യം നിന്നുകൊണ്ടിരിക്കുന്ന സസ്യ-ജന്തുജാലങ്ങളെ അറിയാൻ പഠന സംഘം കടലോരത്ത്

**പരപ്പനങ്ങാടി** ▶ കടലോര മേഖലയിൽ അന്യം നിന്നുകൊണ്ടിരിക്കുന്ന സസ്യജന്തുജാലങ്ങളുമായി ബന്ധപ്പെട്ട പരമ്പരാഗത അറിവുകളുടെ ശേഖരണത്തിനും ക്രോഡീകരണത്തിനായി പഠന സംഘം കടലോരത്ത് എത്തി.

തിരുവനന്തപുരം പാലോട് പ്രവർത്തിക്കുന്ന കെ.എസ്.സി.എസ്.ടി.ഇ ജവഹർലാൽ നെഹ്റു ട്രോപ്പിക്കൽ ബൊട്ടാണിക്കൽ ഗാർഡൻ ആൻഡ് റിസർച്ച് ഇൻസ്റ്റിറ്റ്യൂട്ട് പ്രതിനിധിയാണ് പരപ്പനങ്ങാടി കടപ്പുറത്ത് വന്ന പരമ്പരാഗത മത്സ്യത്തൊഴിലാളികളുമായി സംവദിച്ച് വിവരങ്ങൾ ശേഖരിച്ചത്. കടലോരത്ത് പഴയ കാലങ്ങളിൽ ഉണ്ടായിരുന്ന ഔഷധ സസ്യങ്ങളുമായി ബന്ധപ്പെട്ട പരമ്പരാഗത അറിവുകളുടെ ശാസ്ത്രീയമായ പഠനവും മറ്റുമാണ് ശേഖരിക്കുന്നത്.



പരപ്പനങ്ങാടി പുത്തൻകടപ്പുറം ഫിഷ്ലാന്റിംഗ് സെന്ററിൽ പരമ്പരാഗത മത്സ്യത്തൊഴിലാളികളുമായി സംവദിച്ച് വിവരങ്ങൾ ശേഖരിക്കുന്ന കെ.എസ്.സി.എസ്.ടി.ഇ ജവഹർലാൽ നെഹ്റു ട്രോപ്പിക്കൽ ബൊട്ടാണിക്കൽ ഗാർഡൻ ആൻഡ് റിസർച്ച് ഇൻസ്റ്റിറ്റ്യൂട്ട് പ്രതിനിധി എസ്.ടി ശരണു മോൾ

കേരള സംസ്ഥാന ശാസ്ത്ര സാങ്കേതിക പരിസ്ഥിതി കൗൺസിലിന്റെ ധനസഹായത്തോടെയാണ് ഔഷധ സസ്യങ്ങളുമായി ബന്ധപ്പെട്ട പരമ്പരാഗത അറിവുകളുടെ ശാസ്ത്രീയമായ ക്രോഡീകരണ പദ്ധതി നടപ്പിലാക്കുന്നത്.

പ്രസ്തുത കൗൺസിലിന് കീഴിലാണ് റിസർച്ച് ഇൻസ്റ്റിറ്റ്യൂട്ട് പ്രവർത്തിക്കുന്നത്. പ്രസ്തുത അന്വേഷണ പഠനങ്ങൾക്കായി പരപ്പനങ്ങാടി നഗരസഭയെ തിരഞ്ഞെടുത്തതിന്റെ ഭാഗമായിട്ടാണ് വിവര ശേഖരണം

നടത്തിയത്. ശാസ്ത്രജ്ഞന്മാരുടേയുള്ള സംഘമാണ് വിവിധ തീരങ്ങളിൽ പഠനത്തിനായി വരുന്നത്. പരപ്പനങ്ങാടി കടലോരത്ത് പ്രോജക്ട് ഓഫീസർ എസ്.ടി ശരണു മോൾ ആണ് കടലോര മേഖലയിലെ പരമ്പരാഗത അറിവുകൾ കൈമുതലുള്ളവരുമായി സംവദിച്ചത്. പുത്തൻകടപ്പുറം ഫിഷ്ലാന്റിംഗിങ് സെന്ററിൽ നടന്ന വിവര ശേഖരണ പരിപാടിക്ക് നഗരസഭ ആരോഗ്യ സ്റ്റാന്ററിംഗ് കമ്മിറ്റി ചെയർമാൻ പി.പി.ഷാഹുൽ ഹമീദ് നേതൃത്വം നൽകി.

പരമ്പരാഗത വിവരരേഖകൾ കണ്ടെത്തി അവരുടെ അനുചരിയോടെ ശേഖരിക്കപ്പെടുന്ന വിവരങ്ങളുടെ സുസ്ഥിരമായ സംരക്ഷണവും വിനിയോഗവുമാണ് പ്രോജക്ടിന്റെ പ്രധാന ലക്ഷ്യം.

Article published in the newspaper, Suprabhatham (Malappuram ed.) about the systematic documentation conducted at Parappanangadi Municipality, Malappuram on 17 March 2024



Interview with Shri. Vasu K, a 70-year-old member of the Muthuvan tribal community residing in Karachal Colony, Mampad Gramapanchayth, Malappuram.



Interview with the informant at Ponnani Municipality, Malappuram.

## DIVISION OF MICROBIOLOGY

The Microbiology division coordinates programmes that explore the Microbial Diversity of Kerala State. The scientific programmes involve survey, inventory, bioprospecting and sustainable utilization of mushroom, microbial and lichen diversity of Western Ghats and establishment of a regional reference centre for mushrooms. The division also maintains a well-established Mushroom herbarium with over 19022 accessions and a microfungal and lichen herbarium. Various forests of Kerala were surveyed for Mushrooms and 261 samples of Mushrooms were collected and processed. Five new species of mushrooms and eight new Indian records were discovered from Western Ghat Forests. Twenty-six gene sequences were deposited in GenBank. Fifty-two samples of foliicolous fungi were collected and added to the existing herbarium. Thirty-seven Lichen samples were collected and added to the existing lichen herbarium.

### **Important achievements**

Survey of the Psathyrellaceae of Kerala State, India, has resulted in the discovery of a remarkable *Candolleomyces* species from the tropical forests. Both morphological and molecular analyses of the internal transcribed spacer (nrITS) region confirmed the novelty and placement of the species in the genus *Candolleomyces*. The species is described with macro and microphotographs, phylogeny and a comparison with related species of *Candolleomyces*. Three species of *Candolleomyces* D. Wächt. & A. Melzer

(Agaricomycetes, Psathyrellaceae) were identified. Among these, two species, e.g., *Candolleomyces brunneopileatus* and *Candolleomyces niveofloccosus*, are new to science, while *Candolleomyces asiaticus* represents a new Indian record.

Urdamycin V isolated from *Streptomyces* OA293 is a recently isolated novel angucycline derivative that in present study was investigated for induction of p53 independent apoptosis in both HPV positive and negative cervical cancer cell lines. Apoptosis induction was via phosphorylation modulation in the cell growth regulating proteins along mTORC2/Akt/p38/Erk pathway.

*Panicum repens* rhizosphere soil samples were collected from different localities of Azhimala beach, Thiruvananthapuram. Rhizosphere actinomycetes were isolated from these samples using serial dilution and plating on Starch Casein Agar containing nystatin and nalidixic acid. 30 actinomycetes isolates were obtained from the rhizosphere samples which were proceeded for fermentation and the fermentation broth after incubation period was extracted with ethyl acetate. The crude extracts were then tested for antibacterial activity against 4 different human pathogens. 19 isolates from 30 selected strains showed antibacterial activity. Two most potential isolates out of the 19 positive actinomycetes were selected for further study and various parameters like Minimum Inhibitory concentration (MIC), Minimum Bactericidal Concentration (MBC) and Minimum Biofilm Inhibitory Concentration (MBIC) were determined.

Described 1 species of foliicolous fungi new to science and reported 7 lichens (5 new to Peninsular India & 2 new records to Kerala State) from various forest localities. Fungal herbarium has over 7125 exsiccates and Lichen herbarium holds 3776 exsiccates deposited under TBGT. Four new species such as *Agaricus brunneodiscus*, *Agaricus albovariabilis*, *Candolleomyces niveofloccosus* and *C. albosquamosus* were described and published in peer reviewed journals.

### **Important activities**

1. Two project programmes were initiated to assess the diversity of wild edible mushroom resources of Kerala and evaluation of its antimicrobial potential.
2. Elucidated mechanism of action of via mTOR inhibition by UrdV leading to apoptosis in cervical cancer.
3. Identification of metabolites in TLC fraction via LCMS pertaining to antimicrobial

activity.

4. Inventorizing the mushrooms resources of Kerala.

### **New species published**

1. *Agaricus* section *Minores*: New and noteworthy species from India.
2. A new species of *Pluteus* sect. *Celluloderma* from Kerala State, India.
3. Two new species of *Pluteus* (*Pluteaceae*) from India based on morphology and ITS-based phylogeny.
4. Morphological and phylogenetic analyses reveal two new species of *Candolleomyces* (*Psathyrellaceae*) from India.
5. *Bheemamyces uvariae* sp. nov. Sabeena, A & Biju, H. (2023).

### **MAJOR INFRASTRUCTURE FACILITIES CREATED AT JNTBGRI**

- a. Aquatic conservatories display gallery: Gallery style display steps for the educational demonstration of Aquatic plants, especially special adaptations, is constructed near the reservoir dam. The structure comprises of five numbers of two feet broad stepping terraces outward and three numbers inward.
- b. As a part of activities to enhance the aesthetic beauty of the garden the 20 m terrace trough of the VMC building is planted with *Dracaena*, *Spathiphyllum* and *Cordyline* provided with *Achetaria azurea* and *Strobilanthes alternata* 'exotica' as ground cover.
- c. As part of the National Bamboo Mission project, a Bamboo Museum/ Bamboo pavilion was also constructed for scientific display and demonstration of Bamboo products for extension-education purpose, also upgraded the Bamboo Craft Centre by establishing some new minor equipments and shifted to the newly constructed building at JNTBGRI Bambusetum.
- d. Biorepository has been developed under BGCI Global Genome Biodiversity Network (GGBN) project comprised of 57 plant species which are endemic to the Western Ghats region of Kerala.
- e. Established a new lab at STEC Puthenthopefor Centre of Excellence in Phytochemical-Nanotechnology (CEP) under the scheme State Higher Research Centres of Excellence in Science and Technology Applications (SHRESTA)-KSCSTE.

- f. Chain link wild animal protection boundary constructed in about 200 m perimeter of the Arboretum nursery.
- g. Constructed a metallic chain link fence of 300 m at Threatened Species Park and 600 m around *Garcinia* Garden. The metallic chain links are fixed on 5 feet high metallic poles raised on cement brick foot, at 2 m intervals.
- h. Extended irrigation line at Bambuset.
- i. Frontage Rose Garden area, re-landscaped with perennial and annual beds, provided with pebble stone background; the road underneath of the Ficus arch is paved with interlocks; entrance of the fruit garden entry point is paved with interlocks; the central nursery backyard landscape in the banks of Chittar developed into a visitor's leisure landscape.
- j. HPLC
- k. LC-MS (CIF): LC-MS has been procured and installed at the Institute Central Instrumentation Facility. LC-MS is a workhorse in the plant metabolite analytical field, and will be useful in phytochemistry, metabolomics, chemotaxonomy and chemical ecology applications.
- l. Metallic chain link fencing around the carpet beds in the front garden.
- m. Mist house with multilayered UV sheets and manual gravitational misting aid and metal benches for hardening of bamboo saplings.
- n. Pergola constructed at the entrance of open orchidarium, and a new trail developed with rows of *Grammatophyllum speciosum* plants.
- o. Poly house near DBT Building.
- p. Purchased INVITROGEN ProFlex™ 3X32 well PCR system.
- q. Renovated Conservatory with Cladding and Drip irrigation system (300 x 350 square meter).
- r. Renovated Butterfly Garden, planting more host plants, fencing and compound wall.
- s. Renovation and roofing of the hardening house in the Central Nursery with 70% transparent roof sheets of 5 x 10 m<sup>2</sup> area.
- t. Renovation of the Fernery and Cycad Garden.
- u. Seedling hardening shed (10 x 4 m<sup>2</sup> plinth area with 70% shade net) constructed in the fruit garden.
- v. Renovated the shallow earthen check-dam across the rivulet in the Bambusetum.

- w. Two poly houses (each with 10 x 7.5 m) with a total of 150 m<sup>2</sup> area constructed at Threatened Species Park, under the *Green Kerala Initiative* Programme funded by KSCSTE as well as Conservation, Eco-restoration and Popularization of three endemic and threatened tree species of Kerala, funded by KFD.
- x. Upgradation of HPTLC.
- y. UV-VIS Spectrophotometer.



New facilities created at CIF, JNTBGRI



Aquatic plants display gallery, JNTBGRI.



Newly constructed museum for scientific display of Bamboo flowers, fruits, shoots, curios and products at JNTBGRI Bambusetum.

### PLANTS FOR SALE AT JNTBGRI

No.	Scientific Name	Common Name/ Local Name	Price
1.	<i>Acalypha fruticosa</i>	<i>Cheru chinni</i>	30
2.	<i>Actinodaphne bourdillonii</i>		50
3.	<i>Adenanthera pavonina</i>	Manchadi	30
4.	<i>Adenium obesum</i>	Desert Rose	50
5.	<i>Aegle marmelos</i>	Koovalam	50
6.	<i>Aeschynanthus radicans</i>	Red lipstick plant	50
7.	<i>Aglaonema costatum</i>	Aglaonema	40
8.	<i>Aglaia</i> sp.	Aglaia	30
9.	<i>Aiphanes horrida</i>	Coyure Palm Tree	50
10.	<i>Allamanda cathartica</i>	Manja kolambi	30
11.	<i>Aloevera</i>	Kattar vazha	30
12.	<i>Alpinia calcarata</i>	Chittaratha	30
13.	<i>Alpinia purpurata</i>	Red Ginger	30
14.	<i>Alternanthera dentata</i>	Alankara cheera	30
15.	<i>Ampelocissus indica</i>	Thamaevalli	30
16.	<i>Annona squamosa</i>	Custard apple, Aatha	30

17.	<i>Annona muricata</i>	Prickly Custard Apple Mullaatha	30 Graft- 100, 150
18.	<i>Anthurium bakeri</i>		50
19.	<i>Anthurium</i> 'miniature red'	Anthurium miniature red	50
20.	<i>Anthurium</i> pot plant	Anthurium Hybrid	150
21.	<i>Anthurium crystallinum</i>		700, 1000
22.	<i>Aphanamixis polystachya</i>	Pithraj Tree	50
23.	<i>Aptenia cordifolia</i>	Baby sun rose	30
24.	<i>Aporosa cardiosperma</i>	Ponvetti	30
25.	<i>Arachis pintoii</i>	Pinto peanut	30
26.	<i>Arachnothryx leucophylla</i>	Panama Rose	30
27.	<i>Areca catechu</i>	Betel nut palm	50
28.	<i>Areca triandra</i>	Andaman kamuku	50
29.	<i>Artemisia parviflora</i>	Karppoorathulasi	30
30.	<i>Artocarpus heterophyllus</i>	Plavu	30 Graft- 200 to 250 Bud- 150 to 200
31.	<i>Artocarpus hirsutus</i>	Aanjili	30
32.	<i>Artocarpus lacucha</i>	Lakkoocha	50
33.	<i>Arundina graminifolia</i> (purple)	Purple Bamboo Orchid	100
34.	<i>Arundina graminifolia</i> (white)	White Bamboo Orchid	50
35.	<i>Asparagus racemosus</i>	Shathavari	30
36.	<i>Averrhoa bilimbi</i>	Ilumbipuli	30
37.	<i>Averrhoa carambola</i>	Anappulinchi	30 Graft - graft- 75 to 100
38.	<i>Ayapana triplinervis</i>	Ayyappana, Vishappacha	30
39.	<i>Azadirachta indica</i>	Veppu	30
40.	<i>Baccaurea courtallensis</i>	Mootti	50

			Graft - 75 to 100
41.	<i>Bacopa monnieri</i>	Brahmi	30
42.	<i>Baliospermum solanifolium</i>	Naagadanthi	30
43.	<i>Bambusa bambos</i>	Aenimula	30
44.	<i>Bambusa mizorameana</i>	Mizoram bamboo	30
45.	<i>Bambusa multiplex</i>	Bush bamboo	30
46.	<i>Bambusa multiplex</i> (Yellow)	Yellow bush bamboo	100
47.	<i>Bambusa multiplex</i> (Wamin)	Bellied yellow bush bamboo	100
48.	<i>Bambusa pallida</i>	Bakhal Bamboo	50
49.	<i>Bambusa tulda</i>	Bengal bamboo	50
50.	<i>Bambusa variegata</i>	Variegated mula	30
51.	<i>Bambusa variegata</i>	Variegated Bamboo	30
52.	<i>Bambusa vulgaris</i> 'vittata'	Manja mula	50
53.	<i>Barleria cristata</i>	Philippine violet	30
54.	<i>Barringtonia racemosa</i>	Samudrakkaya	50
55.	<i>Barringtonia acutangula</i>	Aattupezhu	50
56.	<i>Bauhinia tomentosa</i>	Manaja mandaaram	30
57.	<i>Begonia</i> spp.	Begonia	50
58.	<i>Bentinckia nicobarican</i>	Nicobarianhill Areca palm	50
59.	<i>Biancaea sappan</i> Syn. <i>Caesalpinia sappan</i>	Pathimukham/ Chappanga	50
60.	<i>Bougainvillea spectabilis</i>	Kadalaasu chedi	30
61.	<i>Buchanania lanceolata</i>	Kulamaavu	50
62.	<i>Bunchosia glandulifera</i>	Peanut butter fruit	50
63.	<i>Butea monosperma</i>	Chamatha	150
64.	<i>Caladium</i> spp.		30
65.	<i>Calliandra haematocephala</i>	Powderpuff	30
66.	<i>Calophyllum apetalum</i>	Cherupunna	50

67.	<i>Calotropis gigantea</i>	Erukku	30
68.	<i>Canna generalis</i>	canna	30
69.	<i>Capsicum annuum</i>	Mulaku	30
70.	<i>Carallia brachiata</i>	Vallabham	30
71.	<i>Carpentaria acuminata</i>	Carpentaria Palm	50
72.	<i>Caryota mitis</i>	Fishtail Palm	500
73.	<i>Cassia fistula</i>	Kanikkonna	30
74.	<i>Chamaedorea seifrizii</i>	Bamboo palm	100
75.	<i>Chlorophytum borivilianum</i>	Safed Musli	30
76.	<i>Chlorophytum comosum</i>	Spider plant	30
77.	<i>Chrysophyllum cainito</i>	Star Apple	30 Graft- 75
78.	<i>Chrysopogon zizanioides</i> Syn. <i>Vetiveria zizanioides</i>	Raamacham	30
79.	<i>Cissus quadrangularis</i>	Changalam paranda	30
80.	<i>Citrus maxima</i>	Kambili naarakam	30
81.	<i>Citrus medica</i>	Ganapathi naarakam	30
82.	<i>Citrus reticulata</i>	Chinese orange	30 Layer-75
83.	<i>Clerodendrum laevifolium</i>	Bridal Veil	30
84.	<i>Clitoria ternatea</i>	Shankhupushpam	30
85.	<i>Cocos nucifera</i> 'Sunnanki'		200
86.	<i>Codiaeum variegatum</i>	Croton	30
87.	<i>Coleus amboinicus</i>	Panikoorkka/ Njavara	30
88.	<i>Coleus amboinicus</i> 'variegata'	Garden njavara	50
89.	<i>Coleus scutellarioides</i>	Coleus	30
90.	<i>Coreopsis lanceolata</i>	Lance-leaved coreopsis	30
91.	<i>Cosciniun fenestratum</i>	Maramanjai	50
92.	<i>Couroupita guianensis</i>	Naagalingamaram	50

93.	<i>Crataeva magna</i>	Neermaathalam	100
94.	<i>Cynometra bourdillonii</i>		150
95.	<i>Cyrtostachys renda</i>	Red palm	30
96.	<i>Dalbergia latifolia</i>	Indian Rosewood	30
97.	<i>Dendrocalamus brandisii</i>	Furniture bamboo	30
98.	<i>Dendrocalamus calostachys</i>	Arunachal Bamboo	50
99.	<i>Dendrocalamus hamiltonii</i>	Hamilton's bamboo	30
100.	<i>Dendrocalamus longispathus</i>	Furniture mula	50
101.	<i>Dinochloa andamanica</i>	Vallimula	50
102.	<i>Diospyros bourdillonii</i>	Kaakkakarimaram	150
103.	<i>Diospyros buxifolia</i>	Elichuzhi	50
104.	<i>Diospyros ebenum</i>	Karimaram	50
105.	<i>Diospyros malabarica</i>	Panachi	50
106.	<i>Diospyros montana</i>	Bombay ebony	50
107.	<i>Dipterocarpus indicus</i>	Kaaranjili	100
108.	<i>Dipteracanthus elastica</i>	Bubble Plant	30
109.	<i>Dracaena sanderiana</i>	Lucky bamboo Dracaena	30
110.	<i>Dyopsis lutescens</i>	Yellow palm	50
111.	<i>Dysoxylum malabaricum</i>	Akil	100
112.	<i>Elaeocarpus angustifolius</i> Syn. <i>Elaeocarpus ganitrus</i>	Rudraksham	100
113.	<i>Elaeocarpus munronii</i>		150
114.	<i>Elaeocarpus serratus</i>	Kaara	30
115.	<i>Epipremnum aureum</i>	Money plant	30

116.	<i>Episcia cupreata</i>	Flame violet	30
117.	<i>Episcia</i> 'Pink Acajou'	Flame violet	30
118.	<i>Eryngium foetidum</i>	African malli	30
119.	<i>Eugenia uniflora</i>	Surinam cherry	50
120.	<i>Euphorbia tithymaloides</i>	Frilled Jew Bush	30
121.	<i>Equisetum hyemale</i>	Scouring rush	400
122.	<i>Excoecaria cochinchinensis</i>	Chinese croton	30
123.	<i>Excoecaria cochinchinensis</i> 'variegata'	Variegated Chinese croton	30
124.	<i>Ficus benjamina</i>	Weeping fig Garden fig	30
125.	<i>Ficus benghalensis</i>	Banyan tree Peral	30
126.	<i>Ficus krishnae</i>	Krishna's Butter Cup	250
127.	<i>Ficus microcarpa</i>	Ithi	30
128.	<i>Ficus racemosa</i>	Athi	30
129.	<i>Ficus religiosa</i>	Arayaal	30
130.	<i>Fittonia albivenis</i>	Silver Nerve Plant	30
131.	<i>Flacourtia indica</i>	Akchori	30
132.	<i>Flacourtia inermis</i>	lovi-lovi	30
133.	<i>Flacourtia montana</i>	Kaattusheemanelli	30 Graft-100
134.	<i>Garcinia gummi-gutta</i>	Kudampuli	30 Graft- 150
135.	<i>Garcinia celebica</i> <i>Syn. Garcinia hombroniana</i>	Wild mangosteen	30
136.	<i>Garcinia intermedia</i>	Lemon Drop Mangosteen/ Baraba	50
137.	<i>Garcinia indica</i>	Kokkaampuli	30

138.	<i>Garcinia kydia</i>		100
139.	<i>Garcinia mangostana</i>	Mangosteen	100 Graft- 400
140.	<i>Garcinia xanthochymus</i>	Raajapuli	100
141.	<i>Gardenia jasminoides</i>	Gandharajan	30
142.	<i>Geophila repens</i>	Karimkudangal	30
143.	<i>Gigantochloa albociliata</i>	Clumping bamboo	30
144.	<i>Gigantochloa andamanica</i>	Andaman pole bamboo	30
145.	<i>Gluta travancorica</i>	Chenduruni	100
146.	<i>Glycosmis pentaphylla</i>	Paanal	50
147.	<i>Gmelina arborea</i>	Kumbil	30
148.	<i>Gossypium herbaceum</i>	Paruthi	30
149.	<i>Goepertia rufibarba</i>		30
150.	<i>Goniothalamus rhynchantherus</i>		150
151.	<i>Gymnacranthera canarica</i>	Undappayin	100
152.	<i>Gymnema sylvestre</i>	Chakkarakolli	30
153.	<i>Hibiscus heterophyllus</i>	Native rosella	50
154.	<i>Hibiscus rosa-sinensis</i>	Chembarathi	30
155.	<i>Hibiscus tiliaceus</i> 'variegata'	Aattuparuthi	30
156.	<i>Holmskioldia sanguinea</i>	Cup and saucer plant	30
157.	<i>Hopea parviflora</i>	Kambakam	50
158.	<i>Hopea racophloea</i>	Naykkambakam	150
159.	<i>Humboldtia decurrens</i>	Kaattashokam	50
160.	<i>Humboldtia vahliana</i>	Aattuvanchi	50
161.	<i>Hydnocarpus macrocarpa</i>	Aanamarotti	50
162.	<i>Hydnocarpus wightianus</i>	Marotti	50
163.	<i>Hydrangea macrophylla</i>	Hydrangea	30
164.	<i>Hydrocleys nymphoides</i>	Water poppy	100

165.	<i>Impatiens balsamina</i>	Balsam	30
166.	<i>Ixora coccinea</i>	Thechi	30
167.	<i>Jasminum grandiflorum</i>	Pichi	30
168.	<i>Jasminum sambac</i>	Kuttimulla	30
169.	<i>Justicia</i> sp. (Pink Flower)	Justicia	30
170.	<i>Justicia adhatoda</i>	Adalodakam	30
171.	<i>Adhatoda beddomei</i>	Chittadalodakam	40
172.	<i>Justicia gendarussa</i>	Vaathamkolli	30
173.	<i>Kaempferia galanga</i>	Kacholam	30
174.	<i>Lantana montevidensis</i>	Poochedi	30
175.	<i>Lagerstroemia speciosa</i>	Poomaruthu	30
176.	<i>Lawsonia inermis</i>	Mylanchi	30
177.	<i>Licuala grandis</i>	Fan palm	50
178.	<i>Licula peltata</i>	Giant fan palm	50
179.	<i>Licuala peltate</i> var. <i>sumawongii</i>	Swamp Fan Palm	50
180.	<i>Licuala rumphii</i>	Celebes fan palm	50
181.	<i>Litsea cordata</i>		50
182.	<i>Livingstonia rotundifolia</i>	Table Palm	50
183.	<i>Lophopetalum wightianum</i>	Venkotta	30
184.	<i>Ludwigia sedioides</i>	Mosaic flower	100
185.	<i>Machilus glaucescens</i> Syn. <i>Persea macrantha</i>	Ooravu	30
186.	<i>Madhuca longifolia</i>	Ilippa	50
187.	<i>Magnolia champaca</i>	Chembakam	40
188.	<i>Mallotus philippensis</i>		50
189.	<i>Malpighia glabra</i>	West Indian Cherry	30
190.	<i>Malvaviscus arboreus</i>	Cheriya mulaku chembarathi	30

191.	<i>Mangifera indica</i>	Maavu	30 Graft- 150 to 250
192.	<i>Mansoa alliacea</i>	Garlic vine/ Veluthulli valli	30
193.	<i>Maranta leuconeura</i>	Prayer plant	30
194.	<i>Matourea azurea</i> Syn. <i>Otacanthus coeruleus</i>	Amazon Blue	30
195.	<i>Medinilla cumingii</i>	Rose Grapeor Showy Melastoma	50
196.	<i>Melocanna baccifera</i>	Running bamboo/ walking bamboo	100
197.	<i>Melia dubia</i>	Kaattu veppu	30
198.	<i>Memecylon umbellatum</i>	Kaashavu	30
199.	<i>Mesua ferrea</i>	Naanku	50
200.	<i>Millingtonia hortensis</i>	Indian cork tree	50
201.	<i>Mimusops elengi</i>	Elanji	30
202.	<i>Monstera adansonii</i>	Five Holes Plant	50
203.	<i>Morus alba</i>	Mulberry	30
204.	<i>Murraya koenigii</i>	Kari veppu	30
205.	<i>Myristica fragrans</i>	Jaathi/ Nutmeg	30
206.	<i>Myristica malabarica</i>	Kaattujaathi	50
207.	<i>Myxopyrum smilacifolium</i>	Chathura mulla	30
208.	<i>Nelumbo</i> 'Red Philip'	Hybrid Lotus	300
209.	<i>Nelumbo</i> 'Yellow Peony'	Hybrid Lotus	300
210.	<i>Nelumbo</i> 'Últimate Thousand Petal'	Hybrid Lotus	300 - 500
211.	<i>Neolamarckia cadamba</i>		50
212.	<i>Nepenthes khasiana</i> Hybrids ( <i>N. mirabilis</i> X <i>N. refflesiana</i> )	Pitcher plant/ Sanchi chedi	250 - 750

213.	<i>Nepheleium lappaceum</i>	Rambuttan	30 Graft- 200, 250
214.	<i>Nepheleium ramboutan-ake</i> Syn. <i>Nepheleium mutabile</i>	Pulasan	30 Graft -150
215.	<i>Nothopegia aureo-fulva</i>		150
216.	<i>Nyctanthes arbor-tristis</i>	Pavizhamulla	30
217.	<i>Nuphar lutea</i>	Yellow pond lily	300
218.	<i>Nymphaea</i> 'Atrans X Gigantea'	Hybrid Waterlily	300
219.	<i>Nymphaea colorata</i>	Blue-Petal Waterlily	300
220.	<i>Nymphaea</i> 'Jelueangsab'	Hybrid waterlily	300
221.	<i>Nymphaea X marliacea</i>	Marliacea Waterlily	300
222.	<i>Nymphaea micrantha</i>	Violet aambal	200
223.	<i>Nymphaea nouchali</i>	Blue star waterlily	100
224.	<i>Nymphaea omarana</i>	Omarana Waterlily	100
225.	<i>Nymphaea pubescens</i>	Hairy waterlily	100
226.	<i>Nymphoides</i> sp.	Neyyambal	50
227.	<i>Ochlandra travancorica</i>	Eetta	30
228.	<i>Ocimum basilicum</i>	Raama thulasi	30
229.	<i>Ocimum gratissimum</i>	Kaattuthulasi	30
230.	<i>Orthosiphon aristatus</i>	Poochameesha	30
231.	<i>Pandanus amaryllifolius</i>	Rambha	30
232.	<i>Passiflora edulis</i>	Passion fruit	30
233.	<i>Passiflora trifasciata</i>	Tri-colored Passion Vine	50
234.	<i>Peperomia argyreia.</i>	Watermelon peperomia	30
235.	<i>Peperomia caperata</i>	Emerald ripple peperomia	30
236.	<i>Peperomia obtusifolia</i>	Blunt-leaved peperomia	30
237.	<i>Peperomia scandens</i> 'Variegata'	Cupid Peperomia	30
238.	<i>Pereskia aculeata</i>	Madagascar cherry	30
239.	<i>Persea americana</i>	Avocado, Vennappazham	50

240.	<i>Persea macrantha</i>	Ooravu	50
241.	<i>Petrea volubilis</i>	Queen's Wreath	30
242.	<i>Phaius tankervilleae</i>	Common swamp orchid	250
243.	<i>Phyllanthus emblica</i>	Nelli	30 Graft- 100
244.	<i>Pilea depressa</i>	Baby Toes	30
245.	<i>Pilea involucrata</i>		30
246.	<i>Pinanga coronata</i>	Ivory Cane Palm	50
247.	<i>Piper retrofractum</i> Syn. <i>Piper chaba</i>	Van thippali	30
248.	<i>Piper betle</i>	Vettila	30
249.	<i>Pleurolobus gangeticus</i> Syn. <i>Desmodium gangeticum</i>	Orila	30
250.	<i>Piper longum</i>	Thippali	30
251.	<i>Plumbago auriculata</i>	Neela koduveli	50
252.	<i>Plumbago indica</i>	Chuvanna koduveli	30
253.	<i>Plumbago zeylanica</i>	Vella koduveli	30
254.	<i>Plumeria rubra</i>	Eezhachembakam	50
255.	<i>Polyscias fruticosa</i>	Ming Arali	30
256.	<i>Pongamia pinnata</i>	Ungu/ Pongu	30
257.	<i>Procris repens</i> Syn. <i>Pellionia repens</i>	Trailing watermelon	30
258.	<i>Pseudarthria viscida</i>	Moovila	30
259.	<i>Psidium guajava</i>	Pera	30 Layer- 150
260.	<i>Pterocarpus marsupium</i>	Venga	30

261.	<i>Pterocarpus dalbergioides</i>		50
262.	<i>Pterospermum rubiginosum</i>	Ellootti	50
263.	<i>Ptychosperma macarthurii</i>	Cluster Palm	500
264.	<i>Pterocarpus marsupium</i>	Venga	50
265.	<i>Ptychosperma waitianum</i>		50
266.	<i>Ptychosperma sanderianumi</i>		50
267.	<i>Quassia amara</i>	Bitter wood	30
268.	<i>Quassia indica</i>	Karinjotta	30
269.	<i>Rhapis excelsa</i>	Lady palm	50
270.	<i>Rhododendron simsii</i>	Azalea	50
271.	<i>Rhopaloblastea ugusta</i>	Nicobar majestic palm	50
272.	<i>Rondeletia odorata</i>	Red panama rose	30
273.	Rose	Rose	30
274.	Rose in pot	Rose	50
275.	<i>Russelia equisetiformis</i>	Firecracker Plant	30
276.	<i>Sabal mauritiiformis</i>	Bay-leaf palm	250
277.	<i>Sabal minor</i>	Dwarf palmetto	50
278.	<i>Salacia oblonga</i>	Koranti	30
279.	<i>Salacia reticulata</i>	Pon koranti	50
280.	<i>Sandoricum koetjape</i>	Santol fruit	50
281.	<i>Sapindus trifoliatus</i>	Soap nut/ Soppin kaaya maram	30
282.	<i>Saraca asoca</i>	Ashokam	30
283.	<i>Saraca declinata</i>	Yellow Saraca	100
284.	<i>Selenicereus undatus</i>	Dragon Fruit	100
285.	<i>Semecarpus anacardium</i>	Alakkucheru/ Cherkkuru	50
286.	<i>Semecarpus auriculata</i>		50

287.	<i>Simarouba glauca</i>	Lakshmi tharu	30
288.	<i>Spathiphyllum wallisii</i>	Piece lilly	50
289.	<i>Spathoglottis plicata</i> (Purple)	Philippine Ground Orchid	50
290.	<i>Spathoglottis plicata</i> (Purple cluster flower)		150
291.	<i>Spondias pinnata</i> <i>Syn. Spondias acuminata</i>	Ambazham	50 Graft- 75
292.	<i>Stevia rebaudiana</i>	Sugar Leaf	30
293.	<i>Streptocarpus ionanthus</i> <i>Syn. Saintpaulia ionantha</i>	African violet	40
294.	<i>Strophanthus gratus</i>	Indian rubber vine	30
295.	<i>Strobilanthes alternata</i>	Murikudi	30
296.	<i>Strobilanthes heyneana</i>	Karinkurinji	30
297.	<i>Synsepalum dulcificum</i>	Miracle fruit	100
298.	<i>Syzygium caryophyllatum</i>	Karinjaara	30
299.	<i>Syzygium clavatum</i>		50
300.	<i>Syzygium cumini</i>	Njaaval	30 Graft- 75
301.	<i>Syzygium jambos</i>	Rose apple/ Panineer chaamba	Layer100
302.	<i>Syzygium mundagam</i>	Kaattu chaamba	50
303.	<i>Syzygium samarangense</i>	Chaamba	30 Layer- 75 Graft- 100
304.	<i>Syzygium zeylanicum</i>	Poochappazham	30
305.	<i>Tabernaemontana alternifolia</i>	Nanthyarvattam	30

	'Miniature'		
306.	<i>Tabebuia heterophylla</i>	Tabubia	50
307.	<i>Talinum portulacifolium</i>	Sambar cheera	30
308.	<i>Tamarindus indica</i>	Vaalan puli	30
309.	<i>Tecomaria capensis</i>	Capehoney suckle	30
310.	<i>Tectona grandis</i>	Thekku	30
311.	<i>Terminalia arjuna</i>	Neermaruthu	50
312.	<i>Terminalia bellirica</i>	Thaanni	50
313.	<i>Thunbergia grandiflora</i>	Blue Trumpet Vine	30
314.	<i>Thyrsostachys siamensis</i>	Laathi mula	30
315.	<i>Trapa natans</i>	Water chestnut	100
316.	<i>Trichopus zeylanicus</i> subsp. <i>travancoricus</i>	Arogyappacha	100
317.	<i>Vateria indica</i>	Vellakunthirikkam	100
318.	<i>Vincetoxicum indicum</i> Syn. <i>Tylophora indica</i>	Vallippala	30
319.	<i>Vriesea splendens</i>	Flaming sword	100
320.	<i>Whitfieldia elongata</i>	White Candles	30
321.	<i>Wodyetia bifurcata</i>	Foxtail Palm	400
322.	<i>Wrightia tinctoria</i>	Koppala	30
323.	<i>Xylia xylocarpa</i>	Burma Ironwood	50
324.	Rare Cycads <i>Cycas, Dioon, Encephalartos, Zamia</i>	Cycas, Dioon, Encephalartos, Zamia	200
325.	Rare/ IUCN threatened species		100

## TISSUE CULTURE PLANTS FOR SALE

Item	Variety	Price
Anthurium	Hawaii Orange	50
Anthurium	Caesar Violet	30
Anthurium	Dora	50
Orchid	<i>Dendrobium</i> Pink DP, AJ18	35
Orchid	<i>Dendrobium</i> SONIA	35
Orchid	<i>Dendrobium</i> White	35
Orchid	<i>Dendrobium</i> Venus	35
Orchid	<i>Dendrobium</i> Triple Fantasy	35
Orchid	<i>Dendrobium</i> Indigo Blue	35
Orchid	<i>Phalaeonopsis</i> White/ Medium	50
Orchid	<i>Phalaeonopsis</i> Pink Small/ Medium	50
Banana	'Poovan'	15
Banana	'Robusta'	15
Banana	'Palayankodan'	15
Banana	'Nendran'	15
Pepper cutting	Pepper cuttings	20

## LIBRARY AND INFORMATION CENTRE (LIC)

The Institute Library plays a vital role in facilitating research by providing timely and relevant information to the researchers and scientists. It is one of the best specialized libraries in the field of Botany and allied sciences. Its mission is to build up a relevant collection of information materials and timely dissemination of information. Collection building is one of the important functions of the library. The library caters to the needs of researchers from other Institutions as well as students from other Universities. The resources consist of Books, Journals, Back volumes of Periodicals, CDs, Reports, Reprints, Theses, Maps and Atlases. It houses a total number of:

- Books : 6637
- Thesis : 182
- Technical Report : 130
- Reprints : 1140

▪ Journals	:	21
▪ Back Volumes	:	3546
▪ Reports	:	964
▪ Cds	:	34

Library operations and services are automated. Its services are accessible via campus LAN to enable member's access from their desktops. Digital collection includes Scientific Papers, 'Classic Books in Botany' (in CDs), Annual Reports, and Index to journal articles database. During the year under report, 20 books were added to the Collection. The database of books and journals is being updated on day-to-day basis with details of recently acquired materials. Five Computers are provided for members for Internet browsing alone. To cater to the information needs of the clientele the following services are provided.

- Selective dissemination of Information
- Current awareness services
- Indexing services
- Bibliographic services
- Conference alert services
- Press clippings services
- Reprographic services
- Internet browsing services
- Reference services
- Document Delivery services
- Literature Search Services

Library subscribes to JSTOR Biological Sciences Collection including Global Plants Initiative. The following lists are compiled and updated regularly:

1. List of latest additions
2. List of Current Journals
3. List of Holdings
4. List of CDs
5. List of Publications
6. List of Patents
7. List of Projects
8. List of Ph. D. Theses

The library is using the software LIBSOFT which is an integrated multi-user Library Management System that supports all in house operations of the library. It has different modules like Acquisition, Catalogue, Circulation, Serial Control. Circulation control is bar code enabled.



JNTBGRI Library

## **JNTBGRI PUBLICATIONS FOR SALE**

1. Bamboos at TBGRI by. K. C. Koshy,
2. Bees Herbal Garden A garden in the forest @ JNTBGRI by Mathew, P J et.al.
3. Faunal Denizens @JNTBGRI Butterflies, Birds & Mammals by Anilkumar, S. et. al.
4. Ferns and Lycophytes of Kerala Taxonomy, Cytology and Evolution by Ninan, C A & Mathew, P. M.
5. Flowering Plants of Kerala-A Handbook by T. S. Nayar et.al.
6. Flowering plants of the Western Ghats India Vol.1 & 2 by T. S. Nayar et. al.
7. Fungi of Kerala by Hosagoudar, V. B.
8. Glimpses of Indian Ethnopharmacology by Pushpangadan, P. et. al.

9. Introduction to Orchids” by Abraham & Valsala
10. Live Plants of JNTBGRI by Mohanan, N. & Mathew, P. J.
11. Meliolales of India by Hosagoudar, V. B.
12. Orchids of Eravikulam National Park, Munnar by Saleem, M & Mathew Dan et.al.
13. Plant wonders Evolution and genetics by Sathish Kumar, C.,
14. Poisonous mushrooms of Kerala, India: An illustrated handbook by Bijeesh, C; Pradeep, C. K.& Vrinda, K. B.
15. Students Handbook on Medicinal and Food Plants by Rajasekharan, S. et. al., 2013.
16. Scientific Contributions of JNTBGRI (A Bibliography) by Mathew Dan et.al.
17. മുരിങ്ങ(Mal.).Pushpangadan, P. et.al.
18. വാഴവിഭവങ്ങൾ(Mal.). Pradeep, N. S. et.al.
19. ഓർക്കിഡ്ഷൂഷുകൃഷി:ഒരു മാർഗ്ഗ രേഖ.Saleem et.al.

### EXHIBITIONS CONDUCTED/ PARTICIPATED

- JNTBGRI exhibition team has participated in the Orchid show at Punjab University, Chandigarh in connection with the Orchid Society of India Conference, 3-5 March 2023 (Bagged First place in Flower Arrangement Competition).
- Participated in the exhibition in connection with the “Keraleeyam” program of Govt. of Kerala and actively involved in organizing the Flower Show at six venues (Kanakakkunnu, Balabhavan, LMS compound, Ayyankali Hall premise, Central Stadium and EK Nayanar Park) in Thiruvananthapuram during 1-7 November 2023.
- Participated in the exhibition at Kanakakkunnu, Thiruvananthapuram, in connection with the second anniversary of Kerala Government, 25 May 2023.
- “Ente Keralam” Mega Show Programme, Thiruvananthapuram, 20-27 May 2023.
- 20<sup>th</sup> Kerala Bamboo Fest at Jawaharlal Nehru International Stadium Ground, Kochi, Kerala, 12 -17 January 2024.
- 36<sup>th</sup> Kerala Science Congress, Kasargod, 8-11 February 2024.
- Global Science Festival Kerala (GSFK) 2024 at Life Science Park, Thonnakkal (Feb. 15 to March 15, 2024).
- Orchid Show at Pune, organized by The Orchid Society of India, 15-17 March 2024.
- Palode Mela 2024 (7-14 February 2024).

- Exhibition conducted at Pinarayi in connection with Pinarayi Peruma Cultural Fest 2023 at Kannur during 1-15 April 2023.
- Participated in the Vithura Fest 2023 during 1-10 May 2023.



Honourable Chief Minister Sri Pinarayi Vijayan visited JNTBGRI stall at Pinarayi Peruma Cultural Fest, Kannur.



JNTBGRI stall in the Orchid Show at Pune, organized by The Orchid Society of India (15-17 March 2024).



Dr. A. A. Mao, Director, Botanical Survey of India at JNTBGRI stall in the Orchid Show at Pune, organized by The Orchid Society of India, 15-17 March 2024).



Global Science Festival, Kerala at Thonnakkal (15 January to 15 February 2024).



JNTBGRI stall at 36<sup>th</sup> Kerala Science Congress, Kasargod (8-11 February 2024).



JNTBGRI Stall at Palode Mela 2024 (7-14 February 2024).

## MAJOR RESEARCH PROJECTS UNDERTAKEN

- Development of propagation techniques and establishment of nurseries for indigenous RET plants and species notified under Biological Diversity Act and Promoting Cultivation with the Support of Research Organizations, Kudumbasree and MNREGS. Funded by Kerala State Biodiversity Board. (PI: Dr. A. Nazarudeen; Co-PI: Dr. G. Rajkumar).
- Ecotourism Initiative at JNTBGRI (PI). An amount of Rs.87,95,798/- sanctioned by Kerala State Tourism Directorate.
- Inventory and sustainable utilization of microbial wealth in Kerala. (PI: Dr. C. K. Pradeep).
- Inventory Systematics and Conservation of *Ixora* (L.) (Rubiaceae) of Kerala. Funded by Kerala Forest Department. PI: Dr. G. Rajkumar and Dr. A. Nazarudeen.
- Preparation of Monograph on selected medicinal plants used as substitutes/adulterants in Ayurveda with special reference to *Mesua ferrea* L; An integrated Pharmacognostic, Phytochemical and Pharmacological approach. NMPB funded project.
- Identification of wild *Phyllanthus emblica* of the Western Ghats and establishment of a field gene bank in JNTBGRI. Funded by Kerala Forest Department. PI: Dr. P. S. Jothish.
- Survey and Documentation of Folk use of Plants used by Kani Tribes of Kerala part of Agasthyamala Reserve with Emphasis on Sustainable Livelihood aspects. Funded by Kerala Forest Department. (PI: Dr. G. Rajkumar, Co-PI: Dr. A. Nazarudeen).
- Survey, collection, identification, creation of database, value addition and nutritive evaluation of the wild and underutilized edible fruits of Southern Kerala, Funded by Kerala State Biodiversity Board (PI: Dr. A. Nazarudeen; Co-PI: Dr. G. Rajkumar).
- Tourism Project Initiative at JNTBGRI. An amount of Rs.87,95,798/- sanctioned by Kerala State Tourism Directorate.

## CONTINUING RESEARCH

- Documentation, Database and Conservation of Edible Mushroom Resources of Kerala (PI: Dr. C. K. Pradeep, Funding Agency: Kerala State Biodiversity Board).
- Establishment of Centre of Excellence in Phytochemical Nanotechnology at KSCSTE-JNTBGRI under SHRESTA. (PI: Dr. B. Sabulal, Director, JNTBGRI, Co-

PI: Dr. V. Gayathri, Co-I: Dr. B. Sabulal and Dr. S. Ajikumaran Nair, Budget: 200 Lakhs, Funding Agency: KSCSTE).

- Evaluation and Characterization of Antimicrobial potential of wild Edible Mushrooms of Kerala. (PI: Dr. C. K. Pradeep, Funding Agency: KSCSTE).
- Inventory and sustainable utilization of microbial wealth of Kerala. (PI: Dr. C. K. Pradeep).
- Livelihood Enhancement of Tribal of Njaraneely Ward of Peringammala Panchayat, Thiruvananthapuram, Kerala through plant resource enrichment, buy back and Herbal products development (PI: Dr. S. Binu, Co-PI: Dr. Suja, S. R., Budget: 34.5 lakhs, Funding Agency: DST, Govt of India).
- Phytochemical incorporated scaffolds for regeneration in osteoarthritis - an experimental approach (Mentor: Dr. B. Sabulal; Funding Agency: Inspire Fellowship, Department of Science and Technology, Government of India, Budget: 21.65 Lakhs.
- Sustainable Utilization of Medicinal, Aromatic and Other Potential Economic Plants of the Kerala Region of Western Ghats Through Phytochemical and Pharmacological Means (PI: Dr. B. Sabulal, Funding Agency: KSCSTE, Budget: Rs. 75.23 Lakhs.
- Systematic documentation and Bioprospecting of ethnomedically important medicinal plants on tribal/ traditional knowledge through molecular pharmacological approach (PI: Dr. Suja, S. R., Co-PI: Dr. Vinodkumkar T. G. Nair, Budget: 83.136 lakhs, Funding Agency: KSCSTE).
- Inventory, systematics and conservation of *Ixora* L. of Kerala (PI: Dr. G. Rajkumar & Co PI: Dr. A. Nazarudeen, Funding Agency: Kerala Forest and Wildlife Department).

### **IMPORTANT PROGRAMMES INITIATED**

1. Building a biorepository of Western Ghats medicinal and aromatic plants with financial aid from United States Botanic Gardens and Botanic Gardens Conservation International.
2. Conservation of Vulnerable Sandalwood (*Santalum album* L.) through propagation and reintroduction, funded by Kerala Forest Development Fund for a period of 2019 - 2023.
3. Conservation, Eco restoration and Popularization of three Threatened and Endemic tree species of Kerala, KFD Project.
4. New Edible Mushroom; as part of the ongoing programmes on edible mushrooms

Kerala, one interesting edible mushroom *Coprinopsis cinerea*, thriving in abandoned areca nut husks was collected near JNTBGRI campus. This mushroom that grows naturally on areca nut husks, have been used by the Rajapur Saraswat Brahmin families in the border districts of Kerala and Karnataka since long but the information remains with them only. The species was successfully cultivated in areca nut husks and paddy straw at JNTBGRI.

5. Established a Bamboo Museum cum Incubation Centre with financial aid from Kerala State Bamboo Mission.
6. Establishment of a Bamboo Tissue Culture Unit and Expansion of Bamboo Conservatory at JNTBGRI (Funded by Kerala State Bamboo Mission).
7. Establishment of Centre of Excellence in Phytochemical-Nanotechnology at KSCSTE-JNTBGRI under SHRESTA.
8. Field and nursery data on the listed three species viz. *Dipterocarpus bourdillonii* Brandis, *Hopea racophloea* Dyer and *Syzygium travancoricum* Gamble were documented.
9. Gathered germplasm collections of *Salacia* species (37 accessions of 12 species) from Western Ghats region of Kerala/ Karnataka. Quantification of mangiferin content in different parts (root, leaf and stem) of all the collected species of *Salacia* were done by RP-HPLC analysis. Completed inventory/ mapping/ accurate field data of the wild population of the two trees, *Buchanania barberi* and *Calophyllum apetalum* across the Western Ghats.
10. Initiated project on Cardamom for rainforest conservation: The project aims to identify shade loving cardamom varieties that can be cultivated under shade trees in the plantations, thereby facilitating rainforest conservation in these areas funded by Kerala Forest Development Fund (KFDF), Forest Department, Govt. of Kerala for a period of 2023 - 2026.
11. Initiated re-landscaping of the central nursery backyard landscape in the banks of Chittar, old Rose Garden area and interlock paving of the road underneath the Ficus arch and fruit garden approach road.
12. Kerala Forest Development funded project “Triparty action plan for the reintroduction of Red plants of Kerala” is progressing well.
13. Phytochemical incorporated scaffolds for regeneration in osteoarthritis - an experimental approach.
14. Propagules of *Garcinia imberti* and *Betinckia condappana*, endemic to Southern

Western Ghats and IUCN red listed were collected for species restoration.

15. Screening of rhizosphere actinomycetes from marine plants led to 30 actinomycetes isolates out of which 19 isolates showed antibacterial activity. Three most potential isolates selected for further study and experiments in progress.
16. Seedling stock: a total of 2500 seedlings of *Syzygium palodense* were developed, 80 seedlings of *Madhuca diplostemon* and 20 saplings of *Buchanania abrahamiana* were raised and conserved in JNTBGRI.



Seed of *Madhuca diplostemon* C.B. Clarke) P. Royen

17. Systematic documentation and Bioprospecting of ethnomedically important medicinal plants on tribal/ traditional knowledge through molecular pharmacological approach.
18. Two project programmes were initiated to assess the diversity of wild edible mushroom resources of Kerala and evaluation of its antimicrobial potential. Screened 10 wild edible mushrooms for their antimicrobial properties. Three species showed promising antimicrobial properties. *Streptomyces* sp. WPF1 ethyl acetate extracts efficiently inhibited growth of human pathogens *Streptococcus pyogenes* and *Staphylococcus aureus*. The extract also inhibited biofilm formation by the pathogens. Thin layer chromatography experiments determined the active fraction responsible for antimicrobial/ antibiofilm activity.
19. Two project programmes were initiated to assess the diversity of wild edible mushroom resources of Kerala and evaluation of its antimicrobial potential.

## SIGNIFICANT INNOVATIONS/ OUTSTANDING ACHIEVEMENTS

- A new Mushroom species of genus *Candolleomyces* was discovered from JNTBGRI campus. *Candolleomyces* is a small genus with about 35 species known world-over. The species is described and named as *Candolleomyces albosquamosus* P. K. Nayana & C. K. Pradeep.
- A remarkable little known edible mushroom that sprouts in areca nut husks were collected from Palode and identified as *Coprinopsis cinerea*. This mushroom that grows naturally on areca nut husks, have been used by the Rajapur Saraswat Brahmin families since long but the information remains with them only. In a significant breakthrough, researchers from the Jawaharlal Nehru Tropical Botanic Garden and Research Institute (JNTBGRI) have successfully cultivated this mushroom, sprouting in the husks of areca nuts. This mushroom species, previously reported in the border districts of Kerala and Karnataka, has now been confirmed to flourish in the areca nut husks, opening possibilities for artificial mushroom cultivation in various substrates including areca nut husks and paddy straw. The discovery of *Coprinopsis cinerea* thriving in abandoned areca nut husks not only adds a new dimension to mushroom cultivation but also presents an innovative approach to managing agricultural waste. As researchers delve deeper into the potential applications of this discovery, the implications for sustainable farming and waste utilization are vast and promising.
- A Spice Corner was started at the eastern side of the Medicinal Garden with plants used as spice in Kerala cuisines. The Spice Corner was formally inaugurated by Dr S Pradeep Kumar, Director, JNTBGRI by planting a sapling of *Tamarindus indicus* on 8 November 2023.
- An open house programme was conducted in JNTBGRI on 21 December 2023 in connection with *Navakerala Sadhass* at Vamanapuram Legislative Constituency. Publics were freely allowed to visit the major areas of the Garden. More than 300 peoples visited the Medicinal Garden and Orchidarium.
- *Chimonobambusa marmorea*, a new addition to the Bambusetum - planted on 18th September as a part of Bamboo Day, 2023.
- Deposited 8 strains of endomycorrhiza from orchids at CSIR- MTCC, Chandigarh and received the accession numbers.
- Developed 360° interactive virtual reality videos of JNTBGRI.

- Five new species of Mushrooms were discovered from the forests of Kerala State.
- The Biotechnology and Bioinformatics Division has generated a total income of Rs 20,017,20.
- The sale of *Anthurium crystallinum* hybrid started.
- As part of the *Green Kerala Initiative* programme 20,000 seedlings of threatened species were raised. The state level inauguration of the field planting of phase of the project was done by the Honorable Chief Minister of Kerala by planting *Madhuca diplostemon* seedling.
- As a part of encouraging conservation of the endemic species 374 plants belonging to 16 RET species were distributed to the ‘Pachathuruthu’ programme of *Haritha Kerala Mission* of State Government.
- Garden Management Division has supplied 82 plant materials belonging to 41 indigenous species to Acharya Jagadish Chandra Bose Indian Botanic Garden, Kolkata (on exchange basis).



*Coprinopsis cinerea*



Inauguration of Spice Corner at Medicinal Garden by Dr.S. Pradeep Kumar, Member Secretary, KSCSTE.



Open house programme (21 December 2023), in connection with *Navakerala Sadhass* at Vamanapuram Legislative constituency.

### SPECIAL NEWS AND IMPORTANT EVENTS

- Conducted Abraham Memorial Programme on 16 June 2023 followed by the award function.
- A new mushroom species namely *Pluteus fuscopunctatus* C. K. Pradeep & V. Keerthi was discovered from the forests of Kerala.
- Isolated an Actinomycetes strain designated WP1(1) with efficient action against

pathogenic microbes with crude extract MIC activity in the range of 5 to 10 ug/mL.

- As part of the in-house project, ‘Systematic documentation and Bioprospecting of ethnomedically important medicinal plants on tribal/ traditional knowledge through molecular pharmacological approach’, two documentary films on coastal and tribal traditional practices (60 m. duration each) were recorded.
- Data decoding and data analysis works of coastal areas of Perumbadappu, Pothukallu, Pallipuram, Elamkunnappuzha, Nayarambalam and Edavanakkad and the tribal areas Kuttampuzha and Pudur Gramapanchayath of Kerala are progressing.
- *In vivo* anti-inflammatory study on Carrageenan induced paw edema and formalin induced paw edema with various concentrations of hydroethanolic extract of coded plant on wistar rats was carried out. The coded plant (RN) at 800 µg/ml showed the ability to inhibit protein denaturation, at a maximum of 73.49%. It has substantial antiproteinase activity at various concentrations, with the greatest inhibition of 64.64% at 800 µg/ml, and significantly protects against heat-induced protein denaturation at concentrations between 400 and 800 µg/ml. RN at concentration 600, 700 and 800µg/ml significantly protect the erythrocyte membrane against lysis induced by heat and also in hypotonicity-induced hemolysis and RNHE 800 µg/ml demonstrated the greatest protection (73.84%).
- Two new species, *Candolleomyces brunneopileatus* and *C. niveofloccosus* were discovered from the forests of Kerala State.
- One day open house programme for admitting people free of entry fee was conducted on 20 December 2023 in connection with Nava Kerala outreach programme (18 November 2023 to 24 December 2023) of the State Government.



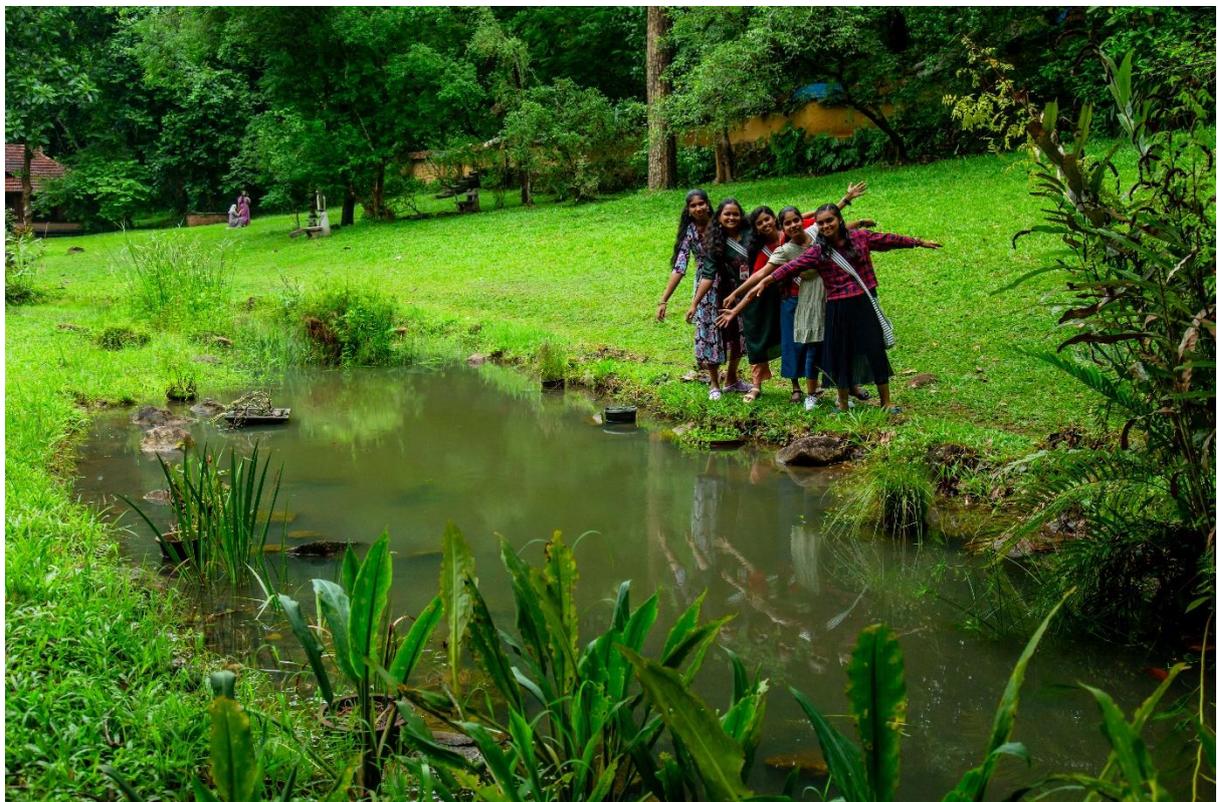
People visit JNTBGRI during the open house programme.



Photo click during the open house programme, JNTBGRI.



Students visiting Itty Achyuthan Vaidyan's Garden, JNTBGRI during the open house programme.



Students enjoying excursion at Itty Achyuthan Vaidyan's Garden, JNTBGRI during the open house programme.

## CONSULTANCY

- Established a Herbal Garden at Christ Nagar College, Maranalloor.

## HYBRID REGISTERED

- A new primary hybrid of *Vanda wightii* x *Acampe praemorsa* registered as Vancampe P Pushpangadan; registered with Royal Horticulture Society, UK.



Vancampe P Pushpangadan. A new primary hybrid of *Vanda wightii* and *Acampepraemorsa*

## NEW PROJECTS

- Characterization and Identification of plus trees of wild *Phyllanthus embilca* (Amla) from Kerala and Establishing a Field Gene Bank, approved by Kerala Forests and Wildlife Department.
- Establishment of Centre of Excellence in Phytochemical-Nanotechnology at KSCSTE-JNTBGRI (SHRESTA Programme, funded by KSCSTE).
- Global Genome Initiative (GGI)-Gardens Award Program, supported by the United States Botanic Garden (USBG) and BGCI for ‘Establishing a biorepository for the plants of the Andaman Islands’ (Award No GGI/2024/1).

## Ph.D. AWARDED

1. Aswathy Anand, (2024). Utility of Semiochemicals and exploitation through *in vitro* technology of *Etilingera fenzlii*, an ethnobotanical insect repellent plant species of the Andaman Nicobar Islands in pest/ insect management and its popularization as an eco-friendly mosquito repellent Products- University of Kerala. Guide: Dr. R. K. Radha.
2. Geetha R Nair, 2023. Antihepatotoxic, Antioxidant and Pharmacognostic studies of *Asystasia chelonoides* var. *chelonoides* Nees, (Acanthaceae). University of Kerala. Supervising Guides: Dr. S R Suja, Dr. M Jayasree.
3. Jisha Daniel, (2023). Systematic Studies and Phytogeographical Affinities of Family Oxalidaceae - Southern Western Ghats, India. University of Kerala.
4. Shubin Felix, (2024). *Ex situ* conservation, molecular and chemical profiling of 'sweet flag' (*Acorus calamus* L.) from Western Ghats. University of Kerala. Guides: Dr. WillamDecruse and Dr. R. K. Radha.

## ACADEMIC PROGRAMMES: Ph.D. PROGRAMMES ONGOING

- Abinlal, K. C. Population Structure, Propagation and Conservation of *Garcinia gamblei* Shameer, T. Sabu & N. Mohanan, An Endemic Species of The Western Ghats. University of Calicut. Guide Dr. Anurag Dhyani.
- Ajinsha, J. S. Ethnobotanical study of Muthuvan tribes of Idukki District of Kerala. University of Kerala. Guide: Dr. G. Rajkumar, Co-guide: Dr. A. Nazarudeen.
- Akhilesh, S. V. Nair. Biosystematics and molecular phylogenetic investigation of the genus *Ophiorrhiza* L. in Western Ghats of India. University of Kerala.
- Aleena Joseph. Assessment of Anti-inflammatory, Anti-arthritic and Wound healing potential of *Malaxis versicolor* (Lindl.) Abeyw. through molecular pharmacological and green synthetic approach. University of Kerala. Guide: Dr. S. R. Suja.
- Aleeshiya Thankam, A. Reproductive Biology and Conservation of *Acrotrema agastyamalayanum* E. S. S. Kumar *et al.* (Dilleniaceae), an Endemic species of the Western Ghats. University of Kerala. Guide: Dr. P. S. Jothish.
- Aneeth Sneha Saj. Evaluation of anti-obesity and anti-diabetic potential of *Biophytum veldkampii* A. E. S Khan, E. S. S. Kumar and Pushp. through molecular pharmacological approach. University of Kerala. Guide: Dr. S. R. Suja.
- Anjana Kartha, A. J. Characterization of Natural populations of *Phyllanthus emblica* L.

- (Amla) in the Southern Western Ghats. University of Kerala. Guide: Dr. P. S. Jothish.
- Anooj, S. L. Ethnobotanical study of Kani tribes in Western Ghats of Kerala. University of Kerala. Guide: Dr. G. Rajkumar, Co-guide Dr. A. Nazarudeen.
  - Anupama Sajeev. Salinity stress profiling of *Clitoria ternatea* L. through integrated Omics approaches. University of Kerala. Guide: Dr. K. K. Sabu.
  - Arunkumar, N. S. Phylogenetic relationships among species of *Strobilanthes* in Kerala by combining evidence from morphology and chemotaxonomy. University of Kerala. Guide: Dr. A. Nazarudeen.
  - Arya, M. R. Studies on Floral Variations in *Clitoria ternatea* L. and its inheritance pattern. University of Kerala. Guides: Dr. S. Suhara Beevy and Dr. Mathew Dan.
  - Arya, C. P. Taxonomic and Phylogenetic Studies on the Genus *Agaricus* (Basidiomycota) of Kerala. University of Kerala. Guide: Dr. C. K. Pradeep.
  - Aswathi, S. V. Molecular docking, spectroscopic investigation and DFT studies of selected bioactive phytochemicals from *Garcinia* species. University of Kerala.
  - Aswathy Chandran. Screening phytochemicals and optimization of lead molecules with inhibitory activity on multiple cobra venom protein. University of Kerala. Guide: Dr. Sreekumar, S., Co-guide: Dr. Biju, C. K.
  - Aswathy V Nair. Insights into the Anti-inflammatory, Wound healing and Gastroprotective potential of *Phyllocephalum rangacharii* (Gamble) Narayana, an ethnomedicinal plant used by Cholanaikkan tribe of Kerala. University of Kerala. Guides: Dr. S. R. Suja, Dr. R. Prakashkumar and Dr. Sushama.
  - Aswathy, J. Phytochemical incorporated scaffolds for regeneration in osteoarthritis - An experimental approach. University of Kerala. Guides: Dr. Annie Abraham, Dr. B. Sabulal.
  - Athira, M. Systematic documentation, phytochemical analysis and comparative toxicological evaluation of *Thottea siliquosa* (Lam.) Ding Hou with tribal herbal preparations of Kerala. University of Kerala. Guides: Dr. Shaiju and Dr. S. R. Suja.
  - Athul Hari, S. Antidiabetic activity of selected *Ficus* species in the Kerala region of Western Ghats. University of Kerala. Guide: Dr. B. Sabulal.
  - Chandni, C. L. Prey capture and pollination in *Nepenthes*: morphology, anatomy, and phytochemical studies of *Nepenthes khasiana* Hook. f. flower and pitcher. University of Kerala. Guides: Dr. Lubaina, A. S., Dr. B. Sabulal.
  - Chinthu R V. Seed physiological studies of *Calophyllum apetalum* Willd., an

economically important endemic tree of Western Ghats, University of Kerala. Guide: Dr. M. Raveendran.

- Devika S. Kumar. The Invasion of Non-Native Plant Species in Ecology and Biodiversity of Different Ecosystems of Thiruvananthapuram District: A Quantitative Approach. University of Kerala.
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- Gokul, B. S. Phytochemical and Biological Activity Studies of Indian Pitcher Plant, *Nepenthes khasiana*. University of Kerala. Guide: Dr. B. Sabulal.
- Greeshma Nair, B. Pharmacological properties of Essential oils and essential oils encapsulated nanoparticles of promising *Thottea* and *Clausena* species. University of Kerala. Guides: Dr. V. Gayathri, Dr. B. Sabulal.
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- Karthika, T. S. Morphotaxonomy and Chemotaxonomy of the Genus *Goniothalamus* Hook. f. & Thoms. (Annonaceae) in The Western Ghats. University of Kerala. Guide: Dr. G. Rajkumar and Dr. K. B. Rameshkumar.
- Keerthi Sugathan. *In silico* and *in vitro* evaluation of anti Covid-19 activity in selected plant-derived nutraceuticals. University of Kerala. Guide: Dr. Sreekumar, S., Co-guide: Dr. C. K. Biju.
- Keerthi. V. Systematic Studies on the Genus *Pluteus* (Basidiomycota, Fungi) of Kerala State. University of Kerala. Guide: Dr. C. K. Pradeep.
- Lakshmi, K. Protocols to produce root derived essential oil through hydroponics, root and hairy root cultures in *Plectranthus vettiveroides* (Jacob) N. P. Singh & B. D. Sharma. University of Kerala. Guide: Dr. Sreekumar, S.

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- Meenakshi Babu, Taxonomic studies on the floristic composition and diversity of Kulathupuzha Forest Range, Kerala. University of Kerala. Guide: Dr. A. Nazarudeen.
- Mohammed Ali Noushad. Analysis of changes in gene expression and identification of differentially expressed miRNAs in cardamom cultivated in high and low altitude areas. University of Kerala. Guide: Dr. K. K. Sabu.
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- Nayana, P. K. Morpho-and molecular taxonomic studies on the genus *Candolleomyces* (Psathyrellaceae, Basidiomycota) of Kerala State. University of Kerala. Guide: Dr. C. K. Pradeep.
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- Neethu, T. Bioprospecting of wild germplasm of *Salacia* species (high-value antidiabetic plants) across the Western Ghats concerning its antidiabetic constituents. University of Kerala.
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- Reshma Elizabeth Alex. Reproductive Biology and Conservation of *Goniothalamus keralensis* ESS Kumar *et al.* (Annonaceae), an Endemic Species of the Western Ghats. University of Kerala. Guides: Dr. P. S. Jothish and Dr. G. Rajkumar.
- Revathy S. Development of Molecular Markers and Population Genetic Structure Analysis of *Cullenia exarillata* A. Robyns (Bombacaceae), an Endemic Species from Western Ghats. University of Kerala. Guide: Dr. K. K. Sabu & Dr. S. William Decruse
- Rijuraj, M. P. Studies on the Lateritic flora and their Ecological adaptive Significance in Northern Kerala, India. University of Kerala.
- Shaina Jerald. *Ex-situ* conservation of Selected Economically Important Lesser-Known Species of the Andaman & Nicobar Islands. University of Kerala. Guides: Dr. A. Gangaprasad and Dr. Sam P. Mathew.
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- Shintu Scaria. Population biology and conservation of *Humboldtia unijuga* var. *trijuga*, a critically endangered tree species of the Western Ghats University of Kerala. Guide: Dr. P. S. Jothish.
- Smridina Ramesh, M. V. Systematics and socio-economic characterization of the floristic elements in the Palode Forest Range, Kerala. University of Kerala. Guide: Dr. A. Nazarudeen.
- Soorya, S. Development of molecular markers for sex determination in palmyra palm. University of Kerala. Guides: Dr. K. K. Sabu & Dr. T. S. Swapna.

- Sowmya S Dharan. Comparative transcriptome profiling of *in vitro* cultured cardamom under heat stress through RNA-seq analysis. University of Kerala. Guide: Dr. K. K. Sabu.
- Sreedevi S Kumar. Scientific validation of comparative antidiabetic effect of root extract and pod extract of *Cyamopsis tetragonoloba* (L.) Taub. with special emphasis on diabetic complications. University of Kerala. Guide: Dr. S. R. Suja.
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- Sreejesh, K. H. Morphological and Molecular Taxonomy of the Genus *Miliusa* Lesch. ex A. DC. (Annonaceae) in India. University of Kerala. Guides: Dr. G. Rajkumar and Dr. K. K. Sabu.
- Sreelekshmi, S. *In silico* and *in vitro* validation of cardio protective activity of Ksherapaka of Lashuna. University of Kerala. Guide: Dr. C. K. Biju.
- Subin Mathew. *In silico* and *in vitro* screening and identification of lead compounds against hepatitis B in selected plants. University of Kerala. Guide: Dr. Sreekumar, S., Co-guide: Dr. C. K. Biju.
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- Vini C Sekhar. Neuropharmacological and molecular effects of polymer encapsulated *Bacopa monnieri* secondary metabolite nanoparticles in kainic acid induced seizures. University of Kerala. Guides: Dr. B. Sabulal, Dr. V. Gayathri.

## INTERNSHIP TRAINING AND DISSERTATIONS

1. Abhirami, K. A. Effect of temperature on seed germination, seedling growth and protein profile of *Pisum sativum* L. M.Sc. Biotechnology. Department of Biosciences, Marthoma College, Thiruvalla, Pathanamthitta, M G University, Kottayam, April to July 2024. Guide: Dr. M. Raveendran.
2. Ajay Chandrasekharan. Analysis of chemical and genetic diversity of *Plectranthus amboinicus*. M.Sc. Biotechnology student from Sir Syed Institute for Technical

- Studies, Karimbam, Taliparamba, Kannur, March to April 2023. Guide: Dr. K. K. Sabu.
3. Aju Ajay. Comparison of Phytochemical Constituents and Evaluating Antioxidant Activity of *Ricinus communis* L. Authentic and Market Samples. M.Sc. Biochemistry, A. J. College of Science and Technology, Thonnakkal, April to June 2023.
  4. Akhil Kumar, H. A. Chemical profiling and preliminary anticancer studies of *Persea macrantha* (Nees) Kosterm leaf essential oil. Department of Biotechnology, St. George College of Management and Science. M.Sc. Biotechnology Internship Training, July to September 2023.
  5. Akhil, S. *In silico* evaluation of phytochemicals from *Murraya koenigii* L. against multiple targets of SARS-CoV-2. St. Thomas College, Palai affiliated to Mahatma Gandhi University, August 2023. Guide: Dr. Sreekumar, S.
  6. Aleena Rose Mathew. Preliminary studies on *in vitro* propagation of *Plumbago rosea* L, a potential medicinal plant through direct organogenesis. Master of Science in Biotechnology, Mahatma Gandhi University, 2024. Guide: Dr. R. K. Radha.
  7. Alfina, S. S. Mass spectrometric studies on the bioactive phytochemical fukugicide. M.Sc. Chemistry, Mar Ivanios College Nalanchira, Thiruvananthapuram, January to March 2024.
  8. Amesh, E. K., Sruthi, B. S., Jeseena, F. S. and Shiji, J. *In vitro* multiplication studies on Dove Orchid *Peristeria elata* Hook. Internship, B.Sc. Botany and Biotechnology, Department of Biotechnology, Govt. Arts college, Thycaud. Guide: Dr. Sreekumar, S. and Co-guide. Dr. R. J. Radhika.
  9. Anamika Salim. Genetic diversity and phytochemical analysis of *Curculigo orchiodes*. M.Sc. Biotechnology student from UC College, Aluva (MG University, Kottayam), April to June 2023. Guide: Dr. K. K. Sabu.
  10. Ananthan, C. A. Systematic Survey on the Cauliflorous Plant species in Peppara Wildlife Sanctuary, Thiruvananthapuram District. Iqbal college, Peringammala, Thiruvananthapuram. M.Sc. Dissertation, University of Kerala, March to June 2024. Guide: Dr. G. Rajkumar.
  11. Aneena Benny. Herbarium Techniques and Management, March 2024.
  12. Aneesha. Nutrient evaluation of three *Agaricus* species. M.Sc. Food Science & Technology, Mahatma Gandhi University, Priyadarshini Hills P.O, Kottayam, June to August 2023.

13. Anisha A., W. Biniya Joshila, R. Ishwarya, J. Jainab Meera, P. Jeya Arockia Anusha, M. Manisha, A. M. Rocklin Binoshia and D. Sahaya Felcia. Dissertation - Plant Tissue Culture. Department of Botany, Holi Cross College (Autonomous), Nagercoil, January 2024. Guide Dr. Sreekumar, S. and Co-guide: Dr. Radhika, R. J.
14. Anjali, V. P. *In silico* Investigation of anti-dengue phytochemicals from selected Medicinal plants. M.Sc. Biotechnology, SNGIST Arts and Science College, Manakkapady, Karumallur P.O., North Paravur, Kochi, May 2023. Guide: Dr. C. K. Biju.
15. Anjana, K. A. Systematic Enumeration and Herbarium Documentation of Medicinal Trees in JNTBGRI Medicinal Plants Grden, Palode. St. Berchmans College, Changanassery, Mahatma Gandhi University. B.Sc. Dissertation, March 2023. Guide: Dr. G. Rajkumar.
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17. Anupama, S. Economic and taxonomic evaluation of the tree species in the Palode Forest Range, Thiruvananthapuram District, Kerala. M.Sc. Dissertation. Iqbal College, Peringammala, University of Kerala, March to May 2024. Guide: Dr. A. Nazarudeen.
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19. Aparna, A. S. Ethnobotanical study of selected Kani settlements in peringammala Grama Panchayat. M.Sc. Dissertation. Christian College Kattakada, Thiruvananthapuram, March to May 2024. Guide: Dr. G. Rajkumar.
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38. Khulzum Shahana, B. Phytochemical and pharmacological evaluation of selected camptothecin containing species. M.Sc. Microbiology, Amrita School of Biotechnology, Amrita Vishwa Vidyapeetham, Amrita University campus, Clappana P. O, Vallikavu, Kollam, January to May 2024.
39. Konda Prashanth. Genetic evaluation and organization of a database of specialty rice, Department of Plant Breeding and Genetics, College of Agriculture Vellayani. Advisory Committee member: Dr. Sreekumar, S.

- 40 Linda Daniel. *In vitro* regeneration studies and bioprospecting of *Curcuma aromatica* and *Curcuma caesia*, Master of Science in Biotechnology, JSS Academy of Higher Education & Research, MYSURU, 2024. Guide: Dr. R. K. Radha.
- 41 Madhan, P. S. Unveiling the Molecular and Biochemical Responses in Medicinal Plant *Ocimum Sanctum* L. to Temperature Variability (Tulsi). M.Sc. Biotechnology student from St. George College of Management and Science, Bengaluru. July to September 2023. Guide: Dr. K. K. Sabu.
- 42 Maheswari, S. Plant Tissue Culture and Bioprospecting of medicinal plants Master of Science in Botany, Ayya Nadar Janaki Ammal College, Sivakasi, MS University, 2024. Guide: Dr. R. K. Radha.
- 43 Manesh, T. S. Comparative Analysis of Phytochemical Constituents and Evaluating Antioxidant Activity of *Calophyllum inophyllum* Seeds. M.Sc. Biochemistry, SNGIST Arts and Science College, Paravur, March to June 2023.
- 44 Merin Thomas Preliminary studies on *in vitro* propagation and antidiabetic potential of *Salacia chinensis* L., a potential medicinal plant of the Western Ghats. Master of Science in Biotechnology, JSS Academy of Higher Education & Research, MYSURU, 2024. Guide: Dr. R. K. Radha.
- 45 Naveenkumar, K. V. Influence of Varying Temperature on Molecular and Biochemical Characteristics of Medicinal Plant *Centella asiatica* (Gotukola). M.Sc. Biotechnology, St. George College of Management and Science, Bengaluru, July to September 2023. Guide: Dr. K. K. Sabu.
- 46 Neethusree, T. Molecular and physiological responses in *Amaranthus tricolor* upon drought stress. M.Sc. Biotechnology, St. Thomas College, Palai (MG University, Kottayam), April to June 2023. Guide: Dr. K. K. Sabu.
- 47 Parvathi, R. Molecular modelling of natural compounds active against *Streptococcus pyogenes* virulence genes. Research Scholar, Department of Botany, University of Kerala, Kariavattom Campus, 2024. Guide: Dr. C. K. Biju.
- 48 Prince Pramod, K. Distribution of benzophenones in selected *Garcinia* species. M.Sc. Chemistry, Amrita School of Physical Sciences, Amrita Vishwa Vidyapeetham, Amrita University campus, Clappana P. O, Vallikavu, Kollam, January to May 2024.
- 49 Rani Joseph. Biotechnology Phytochemical analysis and nano-encapsulation of rhizome oil of *Zingiber zerumbet*. Mary Matha College of Arts and Science, Periykulam, Theni B.Sc. Internship Training, June 2023 to July 2023.

- 50 Renitha, Sahaya Animole and Sahaya Asha Plant Tissue Culture and Bioprospecting of Medicinal plants. M.Sc. Botany, Holy Cross College, Nagercoil, MS University, 2024. Guide: Dr. R. K. Radha.
- 51 Revathy Krishnan. Mass spectrometric studies on the bioactive phytochemical garcinol. M.Sc. Chemistry, Mar Ivanios College Nalanchira, Thiruvananthapuram, January to March 2024.
- 52 Rosmy Varghese. Reviews on the edible plants in the Palode Forest Range and adjoining areas in Thiruvananthapuram District, Kerala. St. Berchmans College, Changanasserry, Mahatma Gandhi University, Kottayam. B.Sc. Dissertation, March 2023. Guide: Dr. A. Nazarudeen.
- 53 Sakthivel, S. Exploring phytochemicals from culinary spices as multi-target inhibitors against SARS-CoV-2: A computational drug discovery approach. Department of Botany, Bharathidasan University, March 2024. Guide: Dr. Sreekumar, S.
- 54 Saran. S. Systematics and Phylogenetic Analysis of *Sageraea thwaitesii* Hook. f. & Thoms. of the family Annonaceae of Shendurney Wildlife Sanctuary, Kerala. Bharathiar University. M. Sc. Dissertation, December 2023 to January 2024.
- 55 Shyam, V. Studies on seed storage, germination, and viability physiognomies of five rare and endemic angiosperms in Kerala. September 2023. Guide: Dr. A. Nazarudeen.
- 56 Sneha Stephen. Gene expression and Bioavailability estimation of *Piriformospora indica* co-cultivated red amaranth (*Amaranthus tricolor*) plants under tenoerature stress conditions. Integrated M.Sc. student, Kerala Agricultural University, College of Agriculture, Vellayani, August 2022 to Jul 2023. Guide: Dr. M. Raveendran.
- 57 Snesha Soman. *In silico* validation of anti-tuberculosis activity and identification of leads with multiple target inhibitions from *Solanum torvum* Sw. M.Sc. Biotechnology, Government College for Women, Thiruvananthapuram, 2024. Guide: Dr. C. K. Biju.
- 58 Sreedevi, R. D. Preliminary studies on *in vitro* propagation of *Rauvolfia vomitoria* Afzel., Master of Science in Botany and Plant Science Technology, Mahatma Gandhi University, 2024. Guide: Dr. R. K. Radha.
- 59 Sreerag Namboothiri, K. N. Phylogenetic analysis of *Orophea* genus. M.Sc. Biotechnology student from Sir Syed Institute for Technical Studies, Karimbam, Taliparamba, Kannur, March to April 2023. Guide: Dr. K. K. Sabu.
- 60 Sreyas, R. Temperature stress responses in *Amaranthus tricolor* revealed through gene expression analysis, Integrated BS-MS, 4th year student from IISER Thiruvananthapuram, June 2023. Guide: Dr. K. K. Sabu.

- 61 Vaishnavi, V. V. Studies on the epiphytic, parasitic, and saprophytic macrophytes in Palode Forest Range, Thiruvananthapuram District, Kerala. Iqbal College, Peringammala, University of Kerala, March to May 2023. M.Sc. Dissertation. Guide: Dr. A. Nazarudeen.
- 62 Vishnu B Unnithan. Comparative Phytochemical and Antioxidant Analysis of *Jatropha curcas* L. Authentic and Market Samples. M.Sc. Biochemistry, A. J. College of Science and Technology, Thonnakkal, April to June 2023.
- 63 Bijisha K. B. Comparative studies on the *in-situ* and *ex-situ* populations of *Trichopus zeylanicus* subsp. *travancoricus* (Bedd.) Burkil ex K. Narayanan. M.Sc. Dissertation, Sree Sankara Collage, Kalady, Mahathma Gandhi University.

## SPECIAL EVENTS

- **World Bamboo Day 2023:** The World Bamboo Day was celebrated on 18 September 2023 at JNTBGRI auditorium with participation of students, public and the staff. The Bamboo Product Designer and Master Craft Trainer, Mr. Rajeev, V. K. has given training to participants in designing and preparing bamboo products. Students from Mar Baselios College of Engineering, Mohandas College of Engineering and Iqbal College have attended the programme. A total of 29 college students and 7 enthusiasts have received training on bamboo identification and crafting.
- **World Environment Day 2023**  
The world environment day was celebrated on 5 June 2023 at JNTBGRI auditorium. Dr. Prathapan, K. D., Associate Professor, Kerala Agriculture University, Vellayani, Thiruvananthapuram has done a talk on ‘Taxonomy of leaf beetles’ during the occasion.

## EXTENSION AND TRAINING: WORKSHOPS/ INTERNSHIPS ORGANIZED

1. A training programme was organized at JNTBGRI by the Garden Management Division for a chosen group of 59 students from Govt. High School, Madathara on 19 July 2023. The training was aimed at familiarizing and explaining fruit plant propagation techniques at the school level.
2. A two-day training programme on orchid farming was conducted at JNTBGRI with 75 beneficiaries during 17 - 18 October 2023.

3. As part of the *Sasthra Sameeksha* Programme organized by JNTBGRI from 22 - 26 May 2023, the Conservation Biology Department has demonstrated to students the activities of the Seed Bank in the process of conserving plant diversity. A total of 280 high school students and teachers representing 20 schools have participated in the programme. The programme was organized by Dr. Mathew Dan as Convenor and Dr. K. K. Sabu as Co-ordinator.
4. Four batches of two-day workshops on Phytochemical & Phytopharmacological Methods were organized at JNTBGRI by the Phytochemistry and Phytopharmacology Division during 17 April 2023 to 16 June 2023. The first batch has received training during 17 - 18 April 2023, the second batch during 18 - 19 May 2023, the third batch during 22 - 23 May 2023 and the fourth batch during 15 - 16 June 2023 respectively.
5. A 4-days workshop on Phytochemical & Phytopharmacology Methods was organized by Phytochemistry and Phytopharmacology Division at KSCSTE-JNTBGRI during 9 - 12 January 2024.
6. The CIF-JNTBGRI has conducted a 14-days refresher course for faculties during 16 January to 1 February 2024 on Gas Chromatographic Techniques in Aromatic Plants Research, a DBT Skill Vigyan State Partnership Programme sponsored by DBT Govt. of India and Kerala Biotechnology Commission, KSCSTE, Govt. of Kerala. Twenty faculties from Kerala, Tamil Nadu, Andhra Pradesh and Karnataka have participated in the programme.
7. JNTBGRI has conducted Prof A. Abraham Memorial Award Competitions on 16 June 2023, a yearly event commemorating late Prof. A. Abraham, the Founder Director of JNTBGRI.
8. One day training and demonstration class for a team of students from Vikram Sarabhai Science Foundation was conducted on 26 May 2023 in connection with the National Science Mentoring Programme.
9. Ayurveda PG Students from Govt. Ayurveda College, Thiruvananthapuram were given training on 17 November 2023.
10. The Biotechnology and Bioinformatics Division offered facility and guidance for 38 Postgraduate and Graduate students, and they have successfully completed their research projects during the period from January to March 2024.

11. The JNTBGRI-STECC, Puthenthoppu center has organized hands-on training sessions titled 'Cultivation, Hybridization, and Value Addition Practice in Orchids'
  - 1) On 11 January 2024, for 52 students of Chinmaya Vidyalaya, Attukal;
  - 2) On 16 January 2024, for 52 students of St. John's Model HSS, Nalanchira;
  - 3) On 29 January 2024, for 48 students of Govt. Higher Secondary School for Girls, Cottonhill, Vazhuthacadu; and
  - 4) On 6 February 2024, for 48 students of Govt. High School, Avanavancherry, Attingal.These workshops were financially supported under the KSCSTE - MoEF & CC - EEP Kerala - Sustainable Lifestyle Workshop for School Students under the National Green Crops Scheme.
12. The Phytochemistry and phytopharmacology Division has conducted one-week *Karyashala* Programme during 13-20 March 2024 for a group of 20 students. The programme was sponsored by DST-SERB Govt. of India.
13. The Phytochemistry and phytopharmacology Division has conducted two weeks Refresher Course for 20 faculties during 16 January to 1 February 2024. The programme was sponsored by DST-SERB Govt of India.
14. The Phytochemistry and Phytopharmacology Division has conducted workshops on 'Phytochemical Techniques' during 17-18 April, 8-9 May, 22-23 May, 15-16 June, 6-7 July, 10-11 August, 28-29 September and 11-12 October 2023.
15. Two days' workshops on 'Phytochemical Techniques' were conducted by CIF-JNTBGRI during 16-17 October 2023. There were 19 participants in the programme.

# Phytochemical Techniques

Two Days Workshop

Organized by

Central Instrumentation Facility

Jawaharlal Nehru Tropical Botanic Garden and Research Institute  
(KSCSTE-JNTBGRI), Palode, Thiruvananthapuram, Kerala



## Workshop content

1. Field visits, Lab visits
2. Extraction Techniques: Soxhlet, Hydrodistillation, Head space, SPME
3. Wet Lab Experiments: Class Tests, Estimations
4. Separation Techniques: TLC, HPTLC, Column Chrom., Flash Chrom., HPLC, GC
5. Hyphenated Techniques: GC-MS, LC-MS
6. Interpretation of spectroscopic data



'Phytochemical Techniques' workshop at CIF-JNTBGRI, 16 - 17 October 2023.



Students of GHS, Avanavancherry, Attingal Practicing Orchid Hybridization Techniques at JNTBGRI-STEAC, Puthenthoppu, 6 February 2024.



Students of St. Johns Model HSS, Nalanchira, Thiruvananthapuram experiencing orchid hybridization techniques at JNTBGRI-STEAC, Puthenthoppu, 16 January 2024.



Students of Chinmaya Vidyalaya Attukal, Thiruvananthapuram Mastering Orchid Hybridization Techniques at JNTBGRI-STEC, Puthenthoppu, 11 January 2024.



Dr. K. K. Sabu speaks in the *Sasthra sameeksha* Programme (22 - 26 May 2023) at JNTBGRI.



Demonstration of simple molecular biology experiments to the students.



Students visiting the Phytochemistry lab.



Workshop on 'Phytochemical and Pharmacological Methods' - Participants and Trainers along with Director Dr. B. Sabulal.

**Phytochemistry and Utilization of Plant Resources**  
 'Gas Chromatographic Techniques in Aromatic Plants Research'

**Refresher Course for Faculties**  
**DBT Skill Vigyan State Partnership Programme**

January 16<sup>th</sup> to February 1<sup>st</sup> 2024 (14 Days)  
 20 faculties from Kerala, Tamil Nadu, Andhra Pradesh and Karnataka participated the programme



**Central Instrumentation Facility**  
**Jawaharlal Nehru Tropical Botanic Garden and Research Institute**  
**(KSCSTE-JNTBGRI), Palode, Thiruvananthapuram-695562, Kerala**



*Supported by*  
 The Department of Biotechnology, Govt. of India  
 Kerala Biotechnology Commission, KSCSTE, Govt. of Kerala

Flyer of the DBT Skill Vigyan State Partnership Programme on Phytochemistry.

**Application of the Hyphenated Mass Spectrometric Techniques**  
**GC-MS and LC-MS in Plant Research**

**Central Instrumentation Facility**  
**Jawaharlal Nehru Tropical Botanic Garden and Research Institute**  
**(KSCSTE-JNTBGRI), Palode, Thiruvananthapuram-695562, Kerala**



20 Participants of PG and PhD students from Kerala, Tamil Nadu, Andhra Pradesh, Karnataka and Gujarat attended the programme.

**KARYASHALA PROGRAMME**



SERB, Govt. of India  
 13<sup>th</sup> to 20<sup>th</sup> March 2024



DST Karyasala Programme CIF-JNTBGRI.

## SEMINARS/ TRAININGS/ WORKSHOPS ATTENDED

- Ajmi Shahul attended a training programme on Molecular Biology Techniques at Unibiosys Biotech Research Labs Kalamassery, Kochi from 5 - 28 July 2023.
- Ajmi Shahul, Aleena Joseph, Aswathy V Nair and Lekshmi S Nath representing the Ethnomedicine and Ethnopharmacology Division have attended a 5-days long training programme on 'Animal handling' at Sree Chitra Tirunal Institute for Medical Sciences and Technology, Poojapura, Thiruvananthapuram during 8 - 12 May 2023.
- Ajmi Shahul attended a two-days long workshop on 'Phytochemical Techniques in Aromatic Plant Research', at JNTBGRI during 10 - 11 August 2023.
- Aleeshiya Thankam and Anjana Kartha have attended One day Seminar on 'Biodiversity Conservation and Eco-Restoration' at Marian College, Kuttikkanam on 29 January 2024.
- Aneeth Sneha Saj has attended 5 days long 'National workshop on Animal cell culture and Molecular Biology Techniques' during 4 - 8 December 2023 at PG & Research Department of Zoology, Mar Ivanios college, Thiruvananthapuram.
- Aneeth Sneha Saj has attended two-days long workshop on 'Phytochemical Techniques in Aromatic Plant Research' at JNTBGRI during 10 - 11 August 2023.
- Anjana H. Nath and K. K. Sabu have participated in the international conference on "Strategies and Challenges in Agricultural and Life Science for Food Security and Sustainable Environment (SCALFE-2023) held during 28-30 April 2023, at Himachal Pradesh University, Summer Hill, Shimla, HP.
- Ajinsha, J. S., Research Scholar, Plant Systematics and Evolutionary Science Division has participated in the 'Five days High-End Workshop and Hands on Training on Classical and Molecular Techniques in Plant and Fungal Identification, sponsored by Anusadhan National Research Foundation and Organized by Kerala Forest Research Institute, Peechi, Thrissur, Kerala during 10 to 15 June 2024.
- Anu, S. and Mathew Dan have attended the 'International Seminar on Gingers' held at Malabar Botanical Garden and Institute for Plant Sciences, Kozhikode, Kerala from 1-3 March 2023.
- Dr. Anurag Dhyani has participated in the webinar 'Conservation Action Tracker, organized by Botanic Gardens Conservation International, Richmond, UK, 5 September 2023.

- Dr. Anurag Dhyani has participated in the one-day Online training programme 'Global Tree Assessment Redlisting Training, organized by Botanic Gardens Conservation International, Richmond, UK on 4 August 2023.
- Ashi Anu Mathew, Research Scholar, Plant Systematics and Evolutionary Science Division has undergone 'Hands on Training on Fundamentals in GIS and Remote Sensing' At IRTC, Jubilee Campus, Palakkad during 9 - 12 July 2024.
- Dr. Biju, C. K. has participated in the workshop and launching of Digital Herbarium of University of Kerala organised by Department of Botany, Kariavattom campus on 23 May 2023.
- Dr. Biju, H. has attended an online workshop on Molecular Identification of Fungi and other Organisms by Dr. Belle Damodara Shenoy Principal scientist, CSIR National Institute of Oceanography, India, organized SN College, Kollam, on 14 October 2023.
- Dr. Biju, H. has attended two online lectures on the topics 'Decay to Delicacy: Diverse roles of Fungi' and 'How to identify a fungal Species' by Dr. Belle Damodara Shenoy, Principal Scientist, CSIR National Institute of Oceanography, India, on 3 October 2023 and 7 October 2023.
- Dr. Biju, H. has participated in the World Fungus Day 2023 organized by MycoIndia Journal on 10 October 2023.
- Dr. Jothish, P. S. has attended the webinar on 'Creating Restored Plant Communities More Resistant to Invasion' organized by Society for Ecological Restoration on 7 February 2024.
- Karthika, T. S., Research Scholar, PS & ES Division has participated in the 4<sup>th</sup> DST- SERB School on Chemical Ecology at CES, IISc Bangalore, 8 - 22 July 2023.
- Dr. Rajkumar, G. attended the 'Floristic Diversity of Southern Western Ghats - Phytochemical Perspectives' at the Department of Botany, Women's Christian College, and Research Centre, Nagercovil, 11 March 2023.
- Rasia Beegum, A. attended the '*Sastra Sameeksha*, the science orientation programme for high school students' at JNTBGRI, 22-26 May 2023.
- Dr. Saleem, M. has attended the International Conference cum Workshop on Medicinal and Floricultural Orchids - Lab Techniques to Entrepreneurial Ventures and Orchid Show held on March 15-17, 2024, organized by the Orchid Society of

India and presented a paper titled “Horticulturally Potential Vandas from Western Ghats, India”.

- Sreejesh, K. H., Research Scholar, PS & ES Division has attended the Summer Internship Programme on ‘Application of DNA Barcoding in Molecular Systematics and Biogeography’, organized by the Department of Botany, Madras Christian College, Chennai during 29 May to 14 June 2023.
- Dr. Suja, S. R. has attended hands-on- workshop on ‘Advanced Imaging Applications in Biology’ at RGCB - BIC campus, Aakulam, Thiruvananthapuram during 5 to 9 June 2023.
- Dr. Suja, S. R. has attended 5 days National workshop on Animal cell culture and Molecular Biology Techniques at PG & Research Department of Zoology, Mar Ivanios college, Thiruvananthapuram during 4 to 8 December 2023.

## **INTERIM AND FINAL TECHNICAL REPORTS**

1. Final Technical Report on the project ‘Development of Propagation Techniques and Establishment of Nurseries for Indigenous RET Plants and Species Notified under Biological Diversity Act and Promoting Cultivation with the support of Research Organizations, Kudumbasree and MNREGS’ has been submitted to the Kerala State Biodiversity Board on 23 November 2023. PI: Dr. A. Nazarudeen.
2. First year report on the Kerala Forest Development funded project ‘Triparty action plan for the reintroduction of Red Category Plants of Kerala’ has been submitted in July 2023.
3. Published 3 volumes (1477 pages) of the Progress Report of the Second phase (December 2019 - November 2021) of the project, ‘Systematic Documentation of Traditional Knowledge related to plants used for food and indigenous medicine’, funded by the Ministry of AYUSH, Government of India (sanctioned to KSCSTE, implemented at KSCSTE - JNTBGRI).
4. Status Report and Statement of Expenditure on the Eco-tourism Initiative at JNTBGRI has been submitted to the Directorate of Tourism, Govt. of Kerala, Thiruvananthapuram on 18 May 2022.
5. Submitted first and second year report (Project Number -NO:19-47/2020/RE) - The Ministry of Environment, Forest and Climate Change (MoEF & CC), Government of India. PI: Dr. R. K. Radha.

6. Submitted quarterly and final progress report to the National Medicinal Plants Board (NMPB), Ministry of Ayush, Govt. of India (F.No.Z.18017/187/CSS/R&D/KE-04/2020-21-NMPB-IV A) - (Project Number R&D/KE-04/2020-21). PI: Dr R. K. Radha.
7. The FTR on the programme, 'Heritage and Aesthetic Garden at Thiruvananthapuram has been submitted to the Hon'ble Chief Minister of Kerala on 24 August 2022.

### **NMPB, SERB AND MOEF & CC SUPPORTED PROJECTS**

1. Biotechnological interventions for defensible conservation and restoration of *Dialium travancoricum* Bourd., a Critically Endangered Endemic Tree of the Southern Western Ghats (SERB Program).
2. Habitat distribution modelling and re-inforcement of threatened trees in the Kerala region of the Western Ghats for the improvement of their conservation status (MoEF & CC Program).
3. Species distribution modelling and bioprospecting of wild germplasm of *Salacia* species (high value anti-diabetic plants) across the Western Ghats (NMPB Program).

### **RESEARCH PUBLICATIONS**

1. Aiswaryalakshmi A. R., Abhin M. Sunil, Bharath M. R., Firosh Raja, Habeel Sahal, T. Sabu and P. O. Nameer, 2023. A Biodiversity Assessment Report of Poredam Temple Sacred Grove, Chadayamangalam, Kollam, India. *Eco. Env. & Cons.* 29 (November Suppl. Issue).
2. Ajikumar Nair, S., Rajani Kurup, Sukumaryamma Remadevi, Smrithi S Lal, Reshma Raju, Raju Antony and Sabulal Baby, 2023. Chemical Composition and Anti-proliferative Activity of Rhizome and Frond Essential Oils of *Anemia schimperiana* subsp. *wightiana*, a Rare Fern Endemic to South India. *Journal of Biologically Active Products from Nature* 13 (2): 105-117.
3. Ajmi Shahul and S. R. Suja, 2023. Comparative Phytochemical and *In Vitro* Antioxidant studies of Ethanolic, Hydroethanolic and Aqueous Root Extracts of *Rhinacanthus nasutus* (L.) Kuntz. *International Journal of Advanced Research Ideas and Innovations in Technology* 9 (6): 916-1178.

4. Anand Aswathy, A., Felix Shibin, P., Mohan Maya, Shan Sasidharan and R. K. Radha, 2023. Acute dermal toxicity study of flower essential oil from *Etilingera fenzlii* (Kurz.) K. Schum. in Wistar albino rats. *Research Journal of Biotechnology* 18 (7): 126-130. DOI: <https://doi.org/10.25303/1807rjbt1260130>.
5. Anilkumar, C., Chitra, C. R., Bindu, S., Sabu, T. and P. S. Jothish, 2023. Genetic diversity of *Ficus krishnae* C. DC. and *Ficus benghalensis* L. *International Journal of Current Research* 15 (2): 23805-23808. DOI: <https://doi.org/10.24941/ijcr.44859.02.2023>.
6. Anjali Jayan and A. K. Sreekala, 2023. Floral biology and pollinator captivating semiochemicals in *Goniothalamus wynaadensis* (Bedd.) Bedd. (Annonaceae) an endemic tree species of the Western Ghats. *Plant Science Today* 10 (3): 399-408.
7. Anusha, P. P., Nithyamol, K. M., Rejitha Joseph, Shailajakumari, S., Shareef, S. M. and E. S. Santhosh Kumar, 2023. Occurrence of multiple albino seedlings in *Madhuca balakrishnanii* (Sapotaceae) an endemic species of the Western Ghats in India. *Journal of Non-Timber Forest Products* 30 (1): 39-41.
8. Anusha, S., Anilkumar, C. and A. Gangaprasad, 2023. Embryo maturation, dormancy, and seed storage behaviour of *Gymnacranthera canarica* (King) Warb, threatened endemic tree species of Southern Western Ghats, India. *Current Botany* (14):1-9. <https://updatepublishing.com/journal/index.php/cb>.
9. Arya, C. P. and C. K. Pradeep, 2024. *Agaricus* Section *Minores*: New and noteworthy species from India. *Phytotaxa* 634 (3):255-273 <https://doi.org/10.11646/phytotaxa.634.3.5>.
10. Arya, C.P. and C. K. Pradeep, 2023. Noteworthy record of edible *Agaricus* (Agaricaceae) from Western Ghats, India. *Indian Phytopathology* 75: 631–635. <https://doi.org/10.1007/s42360-023-00613-0>.
11. Aswathy, S. V., Hubert Joe, I., Rameshkumar, K. B. and Junaida M. Ibrahim, 2024. Insights into the role of RAHB and IHB interactions for the structure-activity relationship of caged xanthone Morellic Acid: Spectroscopic and DFT exploration, molecular docking, and molecular dynamics simulation studies as an anti-tuberculosis agent. *Journal of Molecular Structure* 1303: 137429.
12. Biji, C. L., Ajay Bhaskar, Priyanka, B. R., Sunitha, P., Nadiya, F., Gouri Priya

- Ranjith, Sakthipriya Mathavaraj, Sabu, K. K., Achuthsankar S. Nair, 2023. Development of EST-SSR Markers in Tomato (*Solanum lycopersicum* L). *Informatics Studies* 10 (2): 15-24.
13. Biju Haridas, Sabeena Aliyarukunju and Sanjeeva Nayaka, 2023. Additions to the Lichen Biota of Kerala State, India. *NeBIO* 12 (3): 1-5. ISSN 2278-2281, 0976-3597.
14. Biju, C. K., Lekshmi, R. K. and S. Sreekumar, 2023. Anti-Dengue Leads from *Caesalpinia bonduc* - An *In Silico* Approach. *International Journal of Pharmaceutical Sciences and Drug Research* 15 (4): 445-454.  
<https://ijpsdr.com/index.php/ijpsdr/article/view/7180>.
15. Bindu, S. and C. Anilkumar, 2024. Fruit and seed phenological studies of *Rauvolfia* species distributed in Southern Western Ghats. *Int. J. Life Sci. Res. Updates* 2 (1): 1-8. DOI: <https://doi.org/10.53430/ijlsru.2024.2.1.0021>.
16. Cannon, C., Dhyani, A., Jin, C. and M. River, 2023. The Global Tree Assessment provides a multifaceted view on the future of tree diversity conservation. *Plants People Planet* 5 (4): 461- 465.
17. Chinthu, R. V. and M. Raveendran, 2023. Effect of desiccation damage on the seed viability of *Hydnocarpus alpina* Wight of Western Ghats. *Plant Science Today* 10 (1): 15-21.
18. Chinthu, R. V. and M. Raveendran, 2023. Seed germination and restoration studies of *Hydnocarpus salpina* Wight; an endemic medicinally important tree species of Western Ghats. *International Journal of Science and Development Research* 8 (5): 2455 - 2631.
19. Chinthu, R. V., Raveendran, P. B. and M. Raveendran, 2023. A review on the genus *Calophyllum* L. (Clusiaceae): a potential medicinal tree species. *Plant Science Today* 10 (3): 01- 05. <https://doi.org/10.14719/pst.1818>.
20. Deepu Sivadas, Geethakumary, M. P., Sabu, K. K., Prakashkumar, R. and M. Rajendraprasad, 2023. Jawaharlal Nehru Tropical Botanic Garden and Research Institute and the Global Genome Initiative for Gardens (GGI-Gardens). *BG Journal* 20 (1): 41-43.
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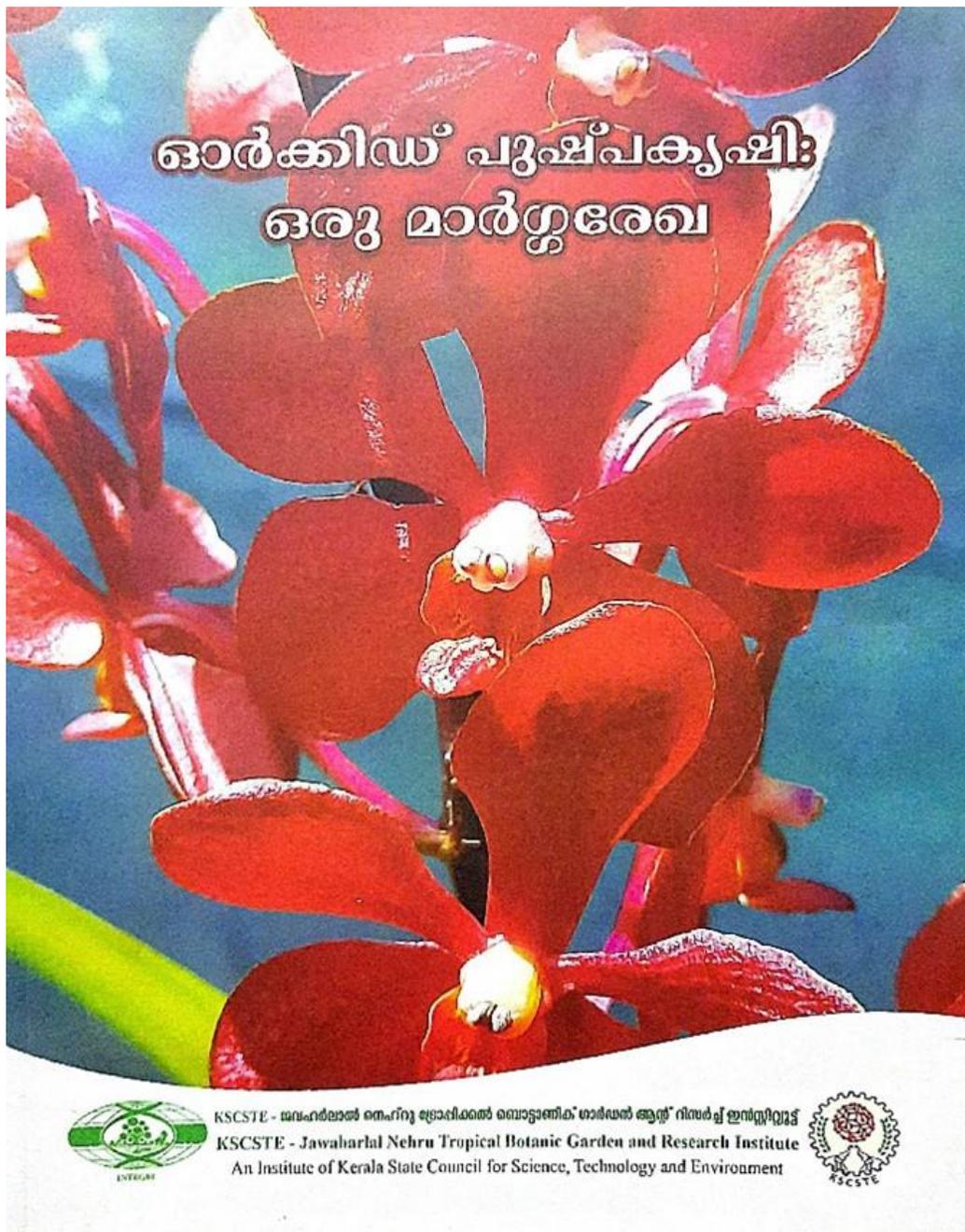


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17. Nayaka, S. and B. Haridas, 2024. Lichen-forming and lichenicolous fungi of Western Ghats, India. In: Pullaiah, T. (Ed.). Biodiversity Hotspot of the Western Ghats and Sri Lanka. Apple Academic Press, Inc. Co-published with CRC Press (Taylor & Francis). Pp. 89 - 107. <https://doi.org/10.1201/9781003408758-6>.
18. Rajani Kurup, S.R., Anil, J. and B. Sabulal, 2023. Essential oils and their constituents in skin care and cosmetics. In: Varughese George and Thadiyan Parambil Ijnu (Eds.). Traditional Medicines in Drug Discovery. Cambridge Scholars Publishing, Newcastle (UK), pp. 429-489.
19. Rajasekharan, S., Nair, V. T. G., Navas, M., James, T. C., and K. Murugan, 2023. Traditional Knowledge and its Sustainable Utilization. In: Swapna Thacheril Sukumaran and Keerthi, T. R. (Eds.). Conservation and Sustainable Development and Biodiversity. Springer, Singapore. <https://doi.org/10.1007/978-981-19-5841-0-25>.
20. Shaju, T. and P. K. Shaji, 2023. Riparian vegetation in Kerala's River basins: Diversity, Ecological functions and Restoration prospects: Eco hydrology of Kerala - River catchments and Coastal Backwaters. pp. 65-75. Elsevier Publication.

21. Shefin, B., Sreekumar, S. and C. K. Biju, 2023. *In silico* validation of anti-tuberculosis activity and identification of lead molecules in *Punica granatum* L. In: Anju, G. (Ed.). Recent Advances in Pharmaceutical Sciences, Vol. 11, pp. 27- 65. Innovare Academic Sciences Pvt. Ltd, India, ISBN: 97-81-958789-4-9.
22. Suja, S. R., Shobha Bhaskar and B. S. Bijukumar, 2023. Cardioprotective Potential of Dietary Phytochemicals Present. The Medicinal Foods of Kerala, South India – A Review: In: Raj Kesarvani, Ragesh Kesarvani, Praveen Kumar Jain, Bishan R Rane, Nayan A Gujrati (Eds.). Nutraceuticals in Cardiac Health Management. Published by Apple Academic Press, CRC Press, a Taylor and Francis group (Published online).
23. Suja, S. R., Shoumya, S., Ajmi, S. and Vinodkumar T G Nair, 2024. Ethnopharmacology, A way forward to Bioprospecting - A glance into the Therapeutic applications of Medicinal/Aromatic plants. In: Phytochemistry and Utilization of Plant Resources Gas Chromatographic Techniques in Aromatic Plants Research. Jawaharlal Nehru Tropical Botanic Garden and Research Institute (KSCSTE-JNTBGRI), Palode, Thiruvananthapuram.
24. Suresh Kumar, K. A., Anil Kumar, C. and K. G. Ajith Kumar, 2023. Storage challenges of Recalcitrant Seeds with Special Reference to Seeds of *Myristica* sp. In: Agricultural Science: Research and Review Volume XII. Bhumi Publishing, NigaveKhalasa, Kolhapur416207, Maharashtra, India. pp. 109-116. ISBN:978-93-88901.
25. Suresh Kumar, K. A., Anil Kumar, C., and K. G. Ajith Kumar, 2023. Exploration Indigenous Knowledge to Sort out Viable Seeds of *Myristica malabarica* Lam. In: Frontiers in Life Science Volume X. Bhumi Publishing, NigaveKhalasa, Kolhapur 416207, Maharashtra, India. pp. 109-116. ISBN: 978-93-88901- 35-2.

## SEMINAR/SYMPOSIA PAPERS

1. Ajinsha, J. S. and G. Rajkumar, 2023. Diversity of Wild Edible Plants Traditionally Used by the Muthuvan Tribes of Kulamankuzhi Settlement of Idukki District of Kerala. International conference on eco Restoration for Natural Resources Management (ICER-NaRM-2023). Department of Zoology and Botany S.T. Hindu College, Nagarcoil, 24-25 August 2023.

2. Ajinsha, J. S. and G. Rajkumar, 2023. Ethnobotanical study of wild edible plants in selected Muthuvan settlements in Adimali, Idukki District, Kerala. International Conference on Biodiversity, Food Security, And Sustainability and Climate Change” (ICBFSCC-2023) at Assam Agricultural University (AAU), Jorhat, Assam, 25 -28 April 2023.
3. Ajinsha, J. S. and G. Rajkumar, 2023. Traditional Remedies of Muthuvan Tribes of Chinnar Wildlife Sanctuary, Kerala, India. Annual Conference of Indian Association for Angiosperm Taxonomy & International Seminar on Advances in Plant Systematic, biogeography and Biodiversity Conservation organised by Department of Botany, University of Calcutta in collaborated with Botanical Survey of India Kolkata, 25-27 November 2023.
4. Ajinsha, J. S. and G. Rajkumar, 2024. Diversity distribution and Conservation of selected *Ixora* sp. in Southern districts of Kerala. Annual Conference of IAAT and International Seminar on Botanical Symphony - Perspectives and Current Challenges in Angiosperm Systematics. Department of Life Science and Bioinformatics, Assam University, Silchar in Collaboration with Botanical Survey of India, Kolkata and Rabindranath Tagore University, Hojai, Assam, 23-25 November 2024.
5. Ajinsha, J. S. and G. Rajkumar, 2024. Ethnobotanical Use of Fruit Plants with Special Reference to the Chinnar Wildlife Sanctuary in Idukki, Kerala, India. International Seminar on Plant Systematics: Present Status and Future Prospects Organised by Department of Botany, University of Calicut, Kerala, 15-17 February 2024.
6. Ajinsha, J. S. and G. Rajkumar, 2024. Ethnomedicinal Plants Traditionally Used by the muthuvan tribes of Kulachivayal Settlement, Kanthalloor, Idukki District, Kerala. International Conference on Multidisciplinary Approaches to SDGs & International Partners Meet 2024. Organised by Rajagiri College of Social Sciences (Autonomous) and Rajagiri Business School, Kochi, 10-13 January 2024.
7. Ajinsha, J. S. and G. Rajkumar, 2024. The Relevance of Non-Wood Forest Products (NWFPs) in the lives and livelihood of Chinnar Wildlife Sanctuary, Idukki District, Kerala. Poster, International Conference on Ecosystem Conservation and Sustainable Development jointly organised by A.E.T College, Bengaluru, Society for Advancement of Biological Science, Bengaluru, 8-9 August 2024.

8. Ajinsha, J. S., G. Rajkumar and A. Nazarudeen, 2024. Diversity and Conservation of the Genus *Ixora* L. in southern districts of Kerala. Poster, 36<sup>th</sup> Kerala Science congress, Govt. College Kasaragod, 8-11 February 2024.
9. Ajmi Shahul, Suja, S. R. and Vinodkumar T G Nair, 2023. Ethnomedicinal importance of *Rhinacanthus nasutus* (L.) Kuntze: evaluation of *in vitro* antioxidant and *in vitro* anti-inflammatory potential. Prof A. Abraham Memorial Award Contest, 2023, KSCSTE-JNTBGRI, 16 June 2023.
10. Akshatha S Ashok, Gayathri S Kamath, Rameshkumar, K. B. and Sreejith Parameswara Panicker, 2023. Evaluating the anticancer efficacy: Bark extracts of *Garcinia gamblei*, *Garcinia gummi-gutta*, and *Garcinia hombroniana* on human melanoma cells. National Seminar on 'Phytochemistry and Translational Research'. Kerala Academy of Sciences, Thiruvananthapuram, held at CLIF, University of Kerala, Thiruvananthapuram, 17-18 November 2023.
11. Aleeshiya A. Thankam and P. S. Jothish, 2024. Role of reproductive biology for the realization of conservation - with reference to *Acrotrema agasthyamalayanam* ESS Kumar *et al.* (Dilleniaceae), endemic species of Kerala. Seminar on Biodiversity Conservation and Eco-Restoration, Marian College, Kuttikkanam, 29 January 2024.
12. Anagha, B., Vipin Mohan Dan and C. K. Pradeep, 2023. Antibiofilm activity of endo-symbiotic bacteria isolated from *Pleurotus giganteus* (Berk) Karunarthana & K. D. Hyde against *Staphylococcus aureus*. International Conference on Biodiversity, Biotechnology and Bioprospects of Fungi for Agricultural, Industrial and Environmental Sustainability (BBBFAIES-2023) & 50<sup>th</sup> Annual Meeting, Mycological Society of India. Centre for Advanced Studies in Botany, University of Madras, Guindy Campus, Chennai.
13. Angala Mathew and C. Anilkumar, 2023. Knowing a herb *Trichopus zeylanicus* subsp. *travancoricus* (Bedd.) Burkill. Prof A. Abraham Memorial Award Contest, JNTBGRI, 16 June 2023.
14. Angala Mathew, Anto Mathew, and C. Anilkumar, 2023. Ecological niche modelling of *Trichopus zeylanicus* subsp. *travancoricus*. International Conference on Recent Trends in Biological Sciences. Inter University Centre for Evolutionary and Integrative Biology (ICEIB), University of Kerala.

15. Anil John, J., Chandni, C. L., Thomas, G., Gokul, B. S., Rajani Kurup, S. R. and B. Sabulal, 2023. Chemical composition of extrafloral nectar in *Nepenthes khasiana* pitchers. 13<sup>th</sup> ICPS International Conference, Himeji, Japan, 26-28 May 2023.
16. Anjana H. Nath, Anith K. N. and K. K. Sabu, 2023. Augmentation of vegetative growth of small cardamom by co-cultivation with *Piriformospora indica*. International Conference on Strategies and Challenges in Agricultural and Life Science for Food Security and Sustainable Environment (SCALFE-2023) held during April 28-30, 2023, at Himachal Pradesh University, Summer Hill, Shimla, HP.
17. Anjana Kartha, A. J. and P. S. Jothish, 2024. Morphological variations in wild *Phyllanthus emblica* L. (Amla) in wild population of Marayoor, Idukki. Seminar on Biodiversity Conservation and Eco-Restoration, Marian College, Kuttikkanam, 29 January 2024.
18. Anooj, S. L. and G. Rajkumar 2024. Role of Non-Wood Forest Products (NWFPS) For Tribal People Livelihoods in Peppara Wildlife Sanctuary. International Seminar on Plant Systematics: Present Status and Future Prospects. Department of Botany, University of Calicut, Kerala, 15-17 February 2024.
19. Anooj, S. L. and G. Rajkumar, 2023. Diversity of wild edible plants traditionally used by the Kani tribe at Peppara Wildlife Sanctuary, Thiruvananthapuram District, Kerala, India. International Conference on Biodiversity, Food security & Sustainability and Climate Change” (ICBFSCC-2023) at Assam Agricultural University (AAU), Jorhat, Assam, 25 -28 April 2023.
20. Anooj, S. L. and G. Rajkumar, 2023. Ethnobotanical Use of Wild Fruit Plants with Special Reference to The Kani Tribe of Peppara Wildlife Sanctuary, Kerala, India. Annual conference of Indian Association for Angiosperm Taxonomy & International Seminar on Advances in Plant Systematic, Biogeography and Biodiversity Conservation. Department of Botany, University of Culcutta in collaborated with Botanical Survey of India, Kolkata, 25-27 November 2023.
21. Anooj, S. L. and G. Rajkumar, 2023. The Study of Potent Folklore Medicinal Plants Used by Kani Triebes of Chemmamkala and Valiyakala Settlement of Agasthyamala Biosphere Reserve, Sothern Kerala. International Conference on Eco restoration for Natural Resources Management (ICER-NaRM-2023).

Department of Zoology and Botany, ST Hindu College, Nagercoil, Tamil Nadu, 24-25 August 2023.

22. Anooj, S. L. and G. Rajkumar, 2024. Role of Non-Wood Forest Products (NWFPs) For Tribal People Livelihoods in Peppara Wildlife Sanctuary. National Seminar on Biodiversity: Exploitation, Exploration and Conservation for Sustainable Development BEECD. Department of Botany, NSS College, Nilamel, sponsored by Kerala State Biodiversity Board Thiruvananthapuram, 30-31 January 2024.
23. Anooj, S. L. and G. Rajkumar, 2024. Study on Potential Folklore Plants Used by Kani Tribes in Peppara Wildlife Sanctuary of Agasthyamala Biosphere Reserve, Kerala. International Conference on Multidisciplinary Approaches to SDGs & International Partners Meet 2024. Rajagiri College of Social Sciences (Autonomous) and Rajagiri Business School, Kochi, 10 - 11 January 2024.
24. Anooj, S. L., G. Rajkumar and A. Nazarudeen, 2024. Ethnobotanical Study of Kani Tribes in Sarkar hills Peppara Wildlife Sanctuary of Kerala. Poster, Transforming Kerala's Economy through One Health Approach. 36<sup>th</sup> Kerala Science Congress. Govt. College, Kasaragod and KSCSTE, Thiruvananthapuram, 8 - 11 February 2024.
25. Anu S and Dan M, 2023. Nutritional significance of starch powder isolated from the rhizomes of *Curcuma* L. (Zingiberaceae) species in South India. 14th Faculty Induction Programme (online), UGC-HRDC, University of Calicut, 5 October 2023.
26. Anusha, S., Anilkumar, C. and A. Gangaprasad, 2023. Non-deep morphophysiological dormancy in seeds of *Gymnacranthera canarica* (King) Warb and conservation of an endemic tropical tree in the *Myrsitca* swamps. New Horizons in Plant Sciences, Theme - Biodiversity and Conservation, University of Kerala, pp. 4.
27. Aparna P Bright, Sumitha B, Mathew Dan and K. B. Rameshkumar, 2023. *Alpinia calcarata* (Haw.) Roscoe and *Alpinia galanga* Willd. - Essential oil and head space volatile chemical analysis. National Seminar on 'Phytochemistry and Translational Research-2023', organised by KAS, Thiruvananthapuram and held at CLIF, University of Kerala, Thiruvananthapuram, during 17 - 18 November 2023.
28. Arya, C. P. and C. K. Pardeep, 2023. Exploring the species diversity of mushroom genus *Agaricus* related potential edible species from Kerala. National seminar on

- ‘Green economy: concepts and perspectives’, organized by Dept. of Botany. Govt. College Madappally, Calicut.
29. Arya, C. P. and C. K. Pardeep, 2024. Morpho and molecular characterization of Genus *Agaricus* section *Minores* revealed new and noteworthy species from Kerala. International Conference on Biodiversity, Biotechnology and Bioprospects of Fungi for Agricultural, Industrial and Environmental Sustainability (BBBFAIES-2023) & 50<sup>th</sup> Annual Meeting, Mycological Society of India. Organized by Centre for Advanced Studies in Botany, University of Madras, Guindy Campus, Chennai.
  30. Arya, M. R., Beevy, S. S. and M. Dan, 2023. Morpho-molecular characterisation and intraspecific diversity assessment in *Clitoria ternatea* L. International Seminar on New Horizons in Plant Sciences 2023. Dept. of Botany, University of Kerala, Kariavattom, 21 - 23 March 2023.
  31. Aswathy J, Annie Abraham, Sabulal Baby, 2023. Investigations on the effects of MAD incorporated alginate-di-aldehyde-gelatin (ADAGMAD) hydrogel on IL-1 $\beta$  induced *in vitro* osteoarthritic model. Prof. A. Abraham Memorial Award Contest 2023, JNTBGRI, 16 June 2023.
  32. Aswathy, J., Sabulal, B., and Annie Abraham, 2023. Investigations on the effect of injectable hydrogel on cartilage regeneration in osteoarthritis, Indo-US Seminar Recent Biochemical Approaches in Therapeutics (RBAT-IX), Department of Biochemistry, University of Kerala, 1 - 3 February 2023.
  33. Athul Hari, S., Ajikumaran Nair, S. and B. Sabulal, 2023. Antihyperglycaemic constituents from *Ficus exasperata* Vahl; International Conference in Advances in Bioresearch, Xcellogen Pvt. Ltd., Thiruvananthapuram, 26 - 27 July 2023.
  34. Biju, H. and A. Sabeena, 2023. Fungal Metabolites in Drug Development and Future of Fungal Systematics. National Webinar, Association of Fungal Biologists, 18 February 2023.
  35. Chandni, C. L., Lubaina, A. S. and B. Sabulal, 2023. Morphology of the Indian pitcher plant *Nepenthes khasiana* Hook. f. National Seminar on Plant Biodiversity, Genetics, Breeding and Biotechnology, Department of Botany University of Calicut, 7 - 8 December 2023.
  36. Gayathri, R. S., Rajani Kurup, S. R., Koshy, K. C. and B. Sabulal, 2023. A review of the Bioprospecting Studies on the endemic flowering plants of Western Ghats

- National Seminar on Green Economy: Concepts and Prospectives. Govt. College Madappally, Kozhikode, 26 - 27 October 2023.
37. Gayathri, R. S., Rajani Kurup, S. R., Koshy, K. C. and B. Sabulal, 2023. Traditional uses and Bioactivity studies of the endemic flowering plants of Western Ghats. International IAAT Conference on Advances in Plant Systematics, Biogeography and Biodiversity Conservation. University of Calcutta, 25 - 27 November 2023.
  38. Gokul, B. S, Anil John, J., Hussain, A. and B. Sabulal, 2023. *Nepenthes* pitchers versus thermogenic flowers: implications in prey capture and pollination. Prof. A. Abraham Memorial Award Contest 2023, JNTBGRI, 16 June 2023.
  39. Gokul, B. S., Anil John, J., Ajikumaran Nair, S., Gayathri, V., Biju, P. G. and B. Sabulal, 2023. Isolation and biological activity studies of two phenolic compounds from the Indian pitcher plant *Nepenthes khasiana*. 13<sup>th</sup> ICPS International Conference, Himeji, Japan, 26 - 28 May 2023.
  40. Gokul, B. S., Anil John, J., Gayathri, V. and B. Sabulal, 2023. Phytochemical investigation and biological activity studies of the Indian pitcher plant, *Nepenthes khasiana*. 35<sup>th</sup> Kerala Science Congress, Mar Baselios Christian College of Engineering and Technology, Kuttikanam, Idukki, 10 -14 February 2023.
  41. Greeshma, B. N., Ajikumaran Nair, S., Sabulal, B. and V. Gayathri, 2023. A novel dual mechanism, criss cross between apoptosis and necroptosis by nano-encapsulated essential oil from *Thottea siliquosa* in breast cancer cells. Prof. A. Abraham Memorial Award Contest 2023, JNTBGRI, 16 June 2023.
  42. Greeshma, B. N., Ajikumaran Nair, S., Sabulal, B. and V. Gayathri, 2023. Nanoencapsulated essential oil from *Thottea siliquosa* induces cell specific anti-cancer activity through simultaneous induction of apoptosis/ necroptosis. International Conference in Advances in Bioresearch, Xcellogen Pvt. Ltd. Thiruvananthapuram, 26 -27 July 2023.
  43. Greeshma, B. N., Ajikumaran Nair, S., Sabulal, B., and V. Gayathri, 2023. Anticancer activity of *Thottea siliquosa* essential oil and its encapsulated nanoparticles in SKBR3 cells. 35<sup>th</sup> Kerala Science Congress, Mar Baselios Christian College of Engineering and Technology, Kuttikanam, Idukki, 10 -14 February 2023.
  44. Jabbar, M. A. and M. Dan, 2023. *Ex situ* Conservation of Wild Relatives of Spices, Medicinal and Aromatic Plants from the Andaman Islands. Spices, Aromatic and Medicinal Plants for Economic Prosperity and Ecological Sustainability. Andaman Science Association, ICAR, Central Island Agricultural Research Institute, Port Blair,

- 5-6 October 2023. (Won Oral Presentation Award (Second position) in the Technical Session I).
45. Kartha, A. J. A. and P. S. Jothish, 2023. Qualitative and quantitative variations in wild *Phyllanthus emblica* L. (Amla) of Kerala, India. International Conference on Emerging Trends in Plant Science Research, 6 -7 March 2023. Catholicate College, Pathanamthitta.
  46. Karthika, T. S., 2023. Topic Chemical ecology- A case study of *Goniothalamus cardiopetalus* (Dalzell) Hook. f. & Thomson (Annonaceae) in the Western Ghats. Poster, XXXIII Annual conference of Indian Association for Angiosperm Taxonomy & International Seminar on Advance in Plant Systematics, Biogeography and Biodiversity Conservation. Department of Botany, University of Calcutta, West Bengal, India in collaboration with Botanical Survey of India, Kolkata, 25 to 27 November 2023.
  47. Keerthi Sugathan, J., Sreekumar, S. and C. K. Biju, 2023. *In silico* evaluation of the anti-SARS-CoV-2 activity in bael tree (*Aegle marmelose* (L.) Correa). 15<sup>th</sup> International Conference on “Agriculture, Horticulture and Plant Science, Organised by The Society of Tropical Agriculture at New Delhi, 24-25 June 2023. (Bagged the Best Paper Presentation Award).
  48. Keerthi Sugathan, J., Sreekumar, S. and C. K. Biju, 2023. Phytochemicals with SARS-CoV-2 multiple targeting potential in *Ananas comosus* (L.) Merr: An *in-silico* approach. International Conference on Advances in Bioresearch (Hybrid), organised by Xcellogen Biotech Pvt. Ltd. Thiruvananthapuram, 26 to 27 July 2023 (Bagged the Best Student Researcher Award and the Best Poster Presentation Award).
  49. Keerthi, V. and C. K. Pradeep, 2003. Report of some remarkable *Pluteus* (Pluteaceae) From Kerala State. National Seminar on Plant Biodiversity, Breeding and Biotechnology. Dept. of Botany. University of Calicut, Kerala.
  50. Nayana, P. K. and C. K. Pradeep, 2024. Unveiling the Hidden diversity of *Condolleomyces* in Kerala: New and noteworthy records. International Conference on Biodiversity, Biotechnology and Bioprospects of Fungi for Agricultural, Industrial and Environmental Sustainability (BBBFAIES-2023) & 50<sup>th</sup> Annual Meeting, Mycological Society of India. Centre for Advanced Studies in Botany, University of Madras, Guindy Campus, Chennai.

51. Neema, M., Suresh, S., Somasundaram, G., Aswathy, G. M., Ravichandran, G., Anitha, P. and K. Suresh, 2024. Variability analysis in Oil palm by exploring morphology and assessing viability and germination of pollen grains. 3rd Indian Horticulture Summit-cum-International Conference-2024. Technological Innovations for Boosting Horticulture Production, Rajasthan Agriculture Institute, Jaipur, Rajasthan, India.
52. Rahul Jose and C. Anilkumar, 2023. Conservation biological studies of *Diospyros cruminata* Thunb. - An endangered tree of Western Ghats. Prof. A. Abraham Memorial Award Contest, JNTBGRI, 16 June 2023.
53. Rahul Jose, Anilkumar, C., Jothish, P. S. and P. A. Jose, 2023. *Ex-situ* conservation of *Diospyros crumenata* Thunb. - An endangered tree of Southern Western Ghats. International Conference on Recent Trends in Biological Sciences. Inter University Centre for Evolutionary and Integrative Biology (ICEIB), University of Kerala.
54. Rashmi, K. A., Nithyamol, K. M., Abdul Jabbar, Joemon Jacob, 2023. *Ex situ* conservation of Palms from the Andaman & Nicobar Islands, a success story by JNTBGRI. Mar Baselios Christian College of Engineering and Technology, Kuttikkanam, Idukki., 12-14 February 2023.
55. Ratheesh, S. and C. K. Pradeep, 2023. Cultivation protocols for some wild edible mushrooms of Kerala. International Conference on Biodiversity, Biotechnology and Bioproducts of Fungi for Agricultural, Industrial and Environmental Sustainability (BBBFAIES-2023) & 50<sup>th</sup> Annual Meeting Mycological Society of India. Centre for Advanced Studies in Botany, University of Madras, Guindy Campus, Chennai.
56. Ratheesh, S. and C. K. Pradeep, 2023. Successful cultivation of giant oyster mushroom *Pleurotus giganteus*. Indian Mushroom Conference-2023. Mushroom Diversity and Diversification: Opportunities and Challenge. Mushroom Society of India, Solan collaboration with ICAR-Directorate of Mushroom Research, Solan AICRP on Mushrooms, Kerala Agricultural University, RARS (SZ), Vellayani.
57. Reshma, E. A., Jothish, P. S. and G. Rajkumar, 2023. Floral Morphology and pollinator trapping mechanism of *Goniothalamus keralensis*, an endemic Annonaceae of Kerala, India. International Conference on Emerging Trends in Plant Science Research. Catholicate College, Pathanathitta, 6 - 7 March 2023.
58. Saleem, M., 2024. Horticulturally potential Vandas from Western Ghats, India. International Conference cum workshop on Resource Development of Medicinal

- and Floricultural Orchids- Lab Techniques to Entrepreneurial Ventures & Orchid Show, Pune, organized by The Orchid Society of India, 15-17 March 2024.
59. Saleem, M., Balaji, V. K. and M. Dan, 2023. Orchids of Eravikulam National Park, Kerala. National Seminar on ‘Multidisciplinary Approaches in Studies, Conservation and Resource Development of Medicinal and Ornamental Orchids’. Dept. of Botany, Punjab University, Chandigarh, 3-5 March 2023.
  60. Saranya Mol, S. T., Vinodkumar T. G. Nair and S. R. Suja, 2024. Systematic Documentation of Coastal Ethnobiology of Eranakulam District, Kerala - A Field Survey. Poster, 36<sup>th</sup> Kerala Science Congress, Govt. College, Kasaragod, Kerala, 8 to 11 February 2024.
  61. Sekhar, V. C., Gulia, K. K., Deepti, A., Baby Chakrapani, P. S., Sabulal, B. and G. Vishwanathan, 2023. Nanoencapsulated Bacoside A and Bacopaside I: Overcoming blood-brain barrier to treat seizures. 35<sup>th</sup> Kerala Science Congress, Mar Baselios Christian College of Engineering and Technology, Kuttikanam, Idukki, 10-14 February 2023.
  62. Shintu Scaria, Jothish, P. S. and C. Anilkumar, 2023. *Ex-situ* conservation through vegetative propagation of *Humboldtia unijuga* Bedd. var. *trijuga* J. Joseph & V. Chandras., a critically endangered tree of southern Western Ghats. Proceedings of the International Conference on Emerging Trends in Plant Science Research. Catholicate College, Pathanamthitta, 6-7 March 2023.
  63. Soorya, S., Swapna T. S. and K. K. Sabu, 2023. Selection of Dominant Reference Gene and Expression of Agamous Gene via QRT-PCR in *Borassus flabellifer* L. Proceedings of the 35<sup>th</sup> Kerala Science Congress, 10-14 February 2023, Mar Baselios Christian College of Engineering and Technology, Kuttikkanam, Idukki. Kerala State Council for Science, Technology & Environment, Thiruvananthapuram.
  64. Sreeja Devi, P. S., Neethu S Kumar and K. K. Sabu, 2024. Anti-diabetic and anti-cancer activities of isolated bioactive fractions from wild and cultivar jackfruit (*Artocarpus heterophyllus* Lam.) genotypes of Southern Kerala. National Conference on Recent Research Trends in Biological Sciences, VTM NSS College, Dhanuvachapuram, 15-18 March 2024.
  65. Suresh, S. 2023. Palynology and its applications. Lecture series for five days in *Sasthra Sameeksha* Science Orientation Program. JTBGRI, 22 to 26 May 2023.

## TALKS AND KEYNOTE ADDRESS

- Dr. Abdul Jabbar M. delivered a motivation talk for students under Vigyan Jyoti Programme at Jawahar Navodaya Vidyalaya, Thiruvananthapuram on 29 June 2023.
- Dr. Abdul Jabbar M. delivered a talk on ‘Conservation and Sustainable Utilization of Medicinal Plants’ as part of ‘Herbal Hugs’ programme at Christ Nagar College, Maranalloor Campus, Kattakkada, on 17 January 2024.
- Dr. Abdul Jabbar M. delivered a talk on ‘Familiarization of Native Plants’ as part of ‘Padanolsavam’ at Govt. High School, Jawahar Colony, on 29 February 2024.
- Dr. Anurag Dhyani has participated (online) as Keynote speaker at the 7<sup>th</sup> International symposium of the Philippine Native Plant Conservation Society and delivered a talk on ‘Seed Conservation of IUCN Threatened Species’ held at North-western University in Laoag, Ilocos Norte, Philippines, 16-17 November 2023.
- Dr. Anurag Dhyani, as a resource person, has made a lecture on the topic ‘Botanic Gardens: Role in Conservation’ in the Workshop on Phytochemical and Phytopharmacological Methods, organized by Phytochemistry and Phytopharmacology Division, JNTBGRI during 9-12 January 2024.
- Dr. Joemon Jacob has done a talk on ‘Plant Wonders and Curious Plants, at N. S. S. College, Pandalam on 23 February 2023.
- Dr. Mathew Dan has delivered a lecture on the topic ‘Relevance of Biosystematics’ in the National seminar on “Taxonomy - Unravelling the Diversity of Flora”, organized by Women’s Christian College, Nagercoil, on 10 August 2023.
- Dr. Mathew Dan has made a lecture on the ‘Characterisation of Raw Drugs for Quality Assurance’ in the webinar series ‘Empowerment of Ayurvedic and Herbal Industry in Kerala’, organised by Care Keralam, Cochin, on 27 April 2023.
- Dr. Rajkumar, G. has inaugurated ‘*Oushada bhavanam*’ programme and delivered a talk on ‘the Necessity and Conservation of Medicinal plants in daily life’. organized by Nanniyode Residence association and Kerala State Medicinal Plants Board, in connection with the World Environment Day, on 5 June 2024.
- Dr. Rajkumar, G. has done a talk on ‘Floristic Diversity of Southern Western Ghats - Phytochemical Perspectives’, organized by the Department of Botany, Women’s Christian College and Research Centre, Nagercoil on 11 March 23.
- Dr. Raju Antony has made a talk on the ‘Morphology of Ferns’ at the Department of Botany, Mar Ivanios College, Thiruvananthapuram on 20 February 2023.

- Dr. Rameshkumar, K. B. has delivered a talk on the topic ‘Recent trends in Aromatic plants research’ as part of the *Karyashala* Programme for students sponsored by DST-SERB, Govt of India and organised by CIF- JNTBGRI, at JNTBGRI on 18 March 2024.
- Dr. Rameshkumar, K. B. has done an online talk on the ‘Floristic diversity of the Western Ghats - Phytochemical Perspective’ in the Refresher Course in Life Science, organized by UGC-Malaviya Mission Teacher Training Centre, University of Calicut, on 11 December 2023.
- Dr. Rameshkumar, K. B. has done a talk on the ‘Floristic Diversity of Western Ghats - Scope for Herbal Technology Start-ups’ in the National Seminar. Department of Botany, St. Stephens College, Pathanapuram on 7 November 2023.
- Dr. Rameshkumar, K. B. has delivered a talk on the topic ‘Phytochemistry in Food Sector. Organised by KAS and Mount Royal College, Munnar, conducted at Mount Royal College, Munnar, Idukki, on 3 March 2023.
- Dr. Rameshkumar, K. B. has done a talk on ‘Headspace volatile chemical analysis - An emerging field in plant science’ in the International Conference on Natural Products, organized by Malaysian Natural Product Society and Universiti Teknologi MARA, Kuala Lumpur, at Hotel Aloft, Kuala Lumpur Sentral, Malaysia during 11-13 September 2023.
- Dr. Rameshkumar, K. B. has done a talk on ‘Hyphenated analytical techniques GC-MS and LC-MS’ in the National Workshop on Instrumental Methods of Analysis, organised by SAIF Facility, University College, Thiruvananthapuram on 28 November 2023.
- Dr. Rameshkumar, K. B. had made a talk on ‘Integrated Approaches in Herbal Technology’ during the International Conference on ‘Integrated Approach for Sustainable Development Employing Scientific Input and Technological Advancement’, organised by PG Department of Biotechnology, Sahodaran Ayyappan Smaraka SNDP Yogam College, Konni, Pathanamthitta, from 22-24 June 2023.
- Dr. Rameshkumar, K. B. has done a talk on the topic ‘Phytochemical Perspective of Ayurveda Biology - Challenges and Opportunities’ during the Global Ayurveda Fest - Ayurveda Biology Conclave, organised by CISSA, Thiruvananthapuram at Green Field Stadium, Thiruvananthapuram, on 2 December 2023.
- Dr. Rameshkumar, K. B. has made a talk on ‘Phytochemistry- The Fascinating Chemistry of Plants’ in the *Sasthra sameeksha* Science Orientation Programme for

School Students, organised by JNTBGRI and sponsored by KSCSTE, on 23 May 2023.

- Dr. Rameshkumar, K. B. has done a talk on ‘Recent developments in phytochemical techniques’ during the one-day medical education program organized by the Department of Pharmacy, Govt. Medical College, Kottayam, on 24 August 2023.
- Dr. Rameshkumar, K. B. has made a talk on ‘Role of Phytochemistry in drug discovery’ in the National seminar on ‘Challenges of phytoconstituents in cancer research’, organized by the Department of Biotechnology, Malankara Catholic College, Mariagiri, on 21 September 2023.
- Dr. Rameshkumar, K. B. has done a talk on ‘Spices, Aromatic and Medicinal Plants - Phytochemical Perspective and Scope for Herbal Technology Start-ups’ during the National Conference on ‘Spices, Aromatic and Medicinal Plants for Economic Prosperity and Ecological Sustainability 2023’, organized by ICAR-CIARI, Port Blair, in Port Blair, Andaman Islands, from 5-6 October 2023.
- Dr. Rameshkumar, K. B. has made a talk on ‘Herbal Technology Start-ups in aromatic plants sector’ during the Refresher Course for Faculties, DBT, Govt of India sponsored Skill Development Programme, conducted at CIF-JNTBGRI, on 30 January 2024.
- Dr. Rameshkumar, K. B. has made a talk on ‘Medicinal Plants: Phytochemical Perspective’ during the National Science Day Programme at Hindustan College of Pharmacy, Kanjirappally, organized by Kerala Academy of Sciences, on 5 March 2024.
- Dr. Rameshkumar, K. B. has made a Keynote Address on ‘Plant Volatile Organic Compounds - An Avenue of Possibilities’ during the 8<sup>th</sup> Edition of Global Conference on ‘Plant Biology and Biotechnology’, organised by Magnus Group LLC Chicago, IL, USA, at Singapore Hotel Village Changi, during 25-27 March 2024.
- Dr. Rameshkumar, K. B. has made a talk on ‘Recent Advances in Aromatic Plants Research- Chemotaxonomy’ during the Refresher Course for Faculties, the DBT, Govt of India sponsored Skill Development Programme, conducted at CIF-JNTBGRI, on 23 March 2024.
- Dr. Rameshkumar, K. B. has delivered a talk on the topic ‘Floristic Diversity of the Western Ghats- Chemical Ecological Perspective. International Conference on ‘Emerging Trends in Plant Science Research’, organised by Catholicate College, Pathanamthitta, 6 -7 March 2023.
- Dr. Rameshkumar, K. B. has made a talk on ‘Recent Advances in Aromatic Plants Research - Chemical Ecology’ in the Refresher Course for Faculties, the DBT, Govt of

India sponsored Skill Development Programme, conducted at CIF-JNTBGRI, on 22 January 2024.

- Dr. Rameshkumar, K. B. gave a talk on ‘The Chemistry of Perfumes’ during the National Science Day Programme at Sree Narayana College, Punalur, organized by Kerala Academy of Sciences, on 1 March 2024.
- Dr. Rameshkumar, K. B., has delivered a talk on ‘Herbal Technology Startups in the Aromatic plants sector’ in the *Karyashala* Programme for students, sponsored by DST-SERB, Govt of India and organised by CIF- JNTBGRI, on 19 March 2024.
- Dr. Rameshkumar, K. B., has delivered a talk on ‘Phytochemical Techniques’ in the *Karyashala* Programme for students, sponsored by DST-SERB, Govt of India and organised by CIF- JNTBGRI, on 14 March 2024.
- Rijuraj, M. P. has done a talk on ‘Socio-Economic significance of low land Grass lands in Lateritic zones of Northern Kerala, India’, organized by the Biodiversity Club, St. Thomas College, Kozhencherry.
- Dr. Sabu, K. K. delivered an invited talk on ‘Use of functional genomics for analysis and management of stress responses in plants’ during the ‘Strategies and Challenges in Agricultural and Life Science for Food Security and Sustainable Environment (SCALFE-2023)’ during April 28-30, 2023, at Himachal Pradesh University, Summer Hill, Shimla, Himachal Pradesh.
- Dr. Sabu, K. K. has done a talk on 31 Jan 2024 on the topic ‘DNA and RNA based molecular markers for plant genetic analysis with special focus on aromatic plants’ in the DBT Skill Vigyan Refresher Course for Faculties held at JNTBGRI from 16 Jan to 1 Feb 2024.
- Dr. Sabu, K. K. has done a talk on the topic ‘Genetic Diversity Evaluation using different software, sequence analysis and primer designing’ in the DST-SERB KARYASHALA: Hands-on Training in Plant Bioprospecting, Analytical Techniques, Sustainable Practices and Opportunities hosted by KSCSTE - Malabar Botanical Garden and Institute for Plant Sciences, Kozhikkode during 20 - 26 March 2024.
- Dr. Sabulal B. has done a talk on the topic ‘Integrated Approaches in Herbal Technology’ in the International Conference on ‘Integrated Approach for Sustainable Development Employing Scientific Input and Technological Advancement’, organized by PG Department of Biotechnology, Sahodaran Ayyappan Smaraka SNDP Yogam College, Konni, Pathanamthitta during 22-24 June 2023.

- Dr. Sabulal, B. has done a talk on the topic ‘Phytochemistry - The Fascinating Chemistry of Plants’ in the *Sasthra sameeksha* Science Orientation Programme for School Students, at JNTBGRI (sponsored by KSCSTE), on 23 May 2023.
- Dr. Saleem M. conducted a lecture on ‘Floriculture’ for the officers of VFCK and SHM, at KVK Mithranikethan, on 28 October 2023.
- Dr. Saleem M. had a talk on ‘Hybridization in Orchids’ with the PG students of Catholicate College, Pathanamthitta.
- Dr. Sreekala, A. K. has delivered a farewell discourse on the topic ‘Implications of plant reproductive biology studies in biodiversity conservation’, at JNTBGRI on 26 July 2023.
- Dr. Sreekumar, S. has delivered an invited lecture on the topic ‘Digital Technology in Taxonomy with emphasis on herbarium digitization - for an add on course herbarium techniques’ organized at the Department of Botany, University of Kerala on 13 July 2023.
- Dr. Sreekumar, S. has delivered an invited talk on the topic ‘Digital technology in taxonomy with emphasis on virtual herbarium of the University of Kerala’ in the workshop and launching of digital herbarium of the University of Kerala, held at the Department of Botany, University of Kerala on 23 May 2023.
- Dr. Suja, S. R. has delivered an invited plenary lecture in the technical session on ‘Traditional knowledge - Valuable lead for Biodiversity prospecting and drug development’ in the International Conference on Environment, Forestry and Sustainable Agriculture held during 23-25 November 2023, organised by IASR at GKVK campus, University of Agriculture, Bengaluru.
- Dr. Suja, S. R. has been invited as a resource person and has done an invited talk on the topic ‘Ethnopharmacology, A way forward to Bioprospecting - A glance into the Therapeutic applications of Medicinal/ Aromatic plants’ in the DBT Skill Vigyan Orientation Course held at JNTBGRI, on 15 January 2024.
- Dr. Vinodkumar T G Nair attended the International Conference on SDGs 2024 as Keynote Speaker and Chaired the technical session on the sub-theme ‘Food, Nutrition and Human Health’, organised by the Rajagiri College of Social Sciences, Kalamassery, Kochi during 10 - 11 January 2024, at Rajagiri Kakkanad Campus.
- Dr. Vinodkumar T. G. Nair delivered a talk on ‘Aromatic plants in Ayurveda’ as part of the DBT Skill Vigyan Orientation Course held at JNTBGRI, on 15 January 2024.
- Dr. Vinodkumar T. G. Nair delivered a talk on ‘*Ovshadha sasyangalum ayurvedavum*’

*in the Sasthra Sameeksha* - the science orientation programme conducted for school students by JNTBGRI, Palode from 22 to 26 May 2023.

- Dr. William Decruse has done a farewell discourse on the topic 'Conservation of Endangered Orchids of Western Ghats' at JNTBGRI on 20 July 2023.



Dr. Vinodkumar T. G. Nair presenting keynote address on the sub-theme 'Food, Nutrition and Human Health', in the technical session at Rajagiri College of Social Sciences, Kalamassery, Kochi during 10 - 11 January 2024 at Rajagiri Kakkanad Campus.

## REPORT PRESENTATIONS

- Abhilash, S., 2023. Reproductive biology and conservation of two endangered balsams: *Impatiens maculata* and *Impatiens elegans* (Balsaminaceae) of the Western Ghats. Ph.D. work report presentation, JNTBGRI, 21 July 2023.
- Aleena Joseph, 2023. Assessment of anti-inflammatory, anti-arthritis and wound healing potential of *Malaxis versicolor* (Lindl.) Abeyw through molecular, pharmacological and green synthetic approach. Ph.D. work report presentation, JNTBGRI, 22 August 2023.
- Anil John, J. and B. S. Gokul, 2023. Travlogue: To the land of rising sun. JNTBGRI, 13 July 2023.
- Arya, C. P., 2023. Taxonomic and phylogenetic studies on the genus *Agaricus*

(Basidiomycota) of Kerala. Ph.D. work report presentation, JNTBGRI, 10 July 2023.

- Aswathy Anand, A., 2024. Utility of semiochemicals and exploitation of *Etligeria fenzlii*, an endemic plant species of the Andaman and Nicobar Islands in pest/ insect management. Ph.D. Pre-submission seminar, Department of Botany, University of Kerala, Kariyavattom, Thiruvananthapuram, 24 January 2024.
- Shefin, B., 2024. *In silico* and *in vitro*, validation of the efficacy of anti-tuberculosis activity in selected medicinal and nutraceutical plants. Ph.D. Pre-submission seminar, Department of Biotechnology, University of Kerala, Kariyavattom, Thiruvananthapuram, 23 February 2024.
- Shibir Felix P., 2024. *Ex-situ* conservation, chemical and molecular profiling of ‘sweet flag’ (*Acorus calamus* L.) germplasm from the Western Ghats. Ph.D. Pre-submission seminar, 5 March 2024.

## VISITOR LECTURES

- Aby Joseph, Assistant Professor and Forensic DNA Consultant, Amity University, Dubai has made a talk on ‘Planting Justice: Role of Botany in Criminal Investigation’, on 3 August 2023, at JNTBGRI
- Dr. C. Sathish Kumar, Former Principal Scientist has made a memorial talk of Prof A. Abraham, on 16 June 2023 at JNTBGRI.
- Dr. Ethan Freid, Botanist, Bahamas National Trust and Leon Levy Native Plant Preserve, Eleuthera has made a talk on ‘Plant Biodiversity and Conservation in the Bahamas’ at JNTBGRI, on 2 August 2023.
- Dr. Prathapan, K. D., Associate Professor, Kerala Agriculture University, Vellayani, Thiruvananthapuram has done a talk on the ‘Taxonomy of leaf beetles’ at JNTBGRI on 5 June 2023, as part of the World Environment Day.
- Padmasree M. C. Dathan, Mentor & Scientific Adviser to CM has made a talk at the event of Prof. A. Abraham Memorial Award function at JNTBGRI on 16 June 2023.
- Prof. (Dr.) S. D. Biju, Delhi University has made a talk on ‘Biodiversity in Crisis: Understanding life through the story of frogs’ at JNTBGRI, jointly with Dr. Kamarudeen Foundation for Biodiversity Conservation (KFBC) on 13 June 2023.



Prof. S. D. Biju, Delhi University speaks on ‘Biodiversity in Crisis: Understanding life through the study of frogs’, JNTBGRI Seminar Hall, 13 June 2023.



Dr. Prathapan, K. D., Associate Professor, Kerala Agriculture University speaks on the ‘Taxonomy of leaf beetles’, 5 June 2023, JNTBGRI.

## PUBLIC EVENTS/ OUTREACH PROGRAMMES

1. Dr. Anurag Dhyani has attended second virtual meeting for Bamboo Phylogeny Group II, 10 October 2023 and 'Tools for Tree Conservation' workshop, supported by National Geography Society and organized by Vietnam National University of Forestry, Hanoi, Vietnam during 25-27 October 2023.
2. Dr. Anurag Dhyani has participated in the 'Botanic Gardens Networking' meeting at Auroville Botanical Gardens, Pondicherry during 9-13 October 2023.
3. Biotechnology and Bioinformatics Division conducted demonstration classes to about 3587 School/ Colleges/ University students, NGOs, Floriculturists etc who have visited JNTBGRI during 2023-2024.
4. Conducted *Sasthra Sameekshathe* science orientation programme conducted for school students by KSCSTE - JNTBGRI, Palode from 22 to 26 May 2023; more than 250 school students participated in the event.
5. Co-organized Inaugural ceremony of Indian Science Congress Kerala Chapter at Dept of Botany, University of Kerala on 18 May 2023.
6. For the establishment of closer ties and interaction with the elected local body members of Gramapanchayats and traditional knowledge holders to establish good rapport for the documentation of traditional knowledge, the Ethnomedicine and Ethnopharmacology Division of JNRBGRI has convened meetings at Veliyancode (20 December 2023), Mangalam (21 December 2023), Vettom (21 December 2023) and Purathur (22 December 2023), Mampad (17 January 2024), Chaliyar (17 January 2024), Chungathara (18 January 2024), Nirmarathur (13 March 2024) and Valikkunnu (13 March 2024) Gramapanchayats and Ponnani (11 March 2024) and Parappanangadi (13 March 2024) Municipalities of Malappuram District, Kerala.
7. Dr. Mathew Dan has participated in a project discussion meeting with State Medicinal Plant Board of Chhattisgarh along with the Member Secretary and other officials from KSCSTE Institutions during 25 to 27 September 2023.
8. Dr. Mathew Dan served as a member in the Expert group committee on Assistance to Botanic Garden (ABG) program by MOEF & CC, Govt. of India, on 29<sup>th</sup> November 2023.
9. Dr. Mathew Dan served as a panelist on 'Plant Taxonomy and Biodiversity: cross-sectoral linkages & impacts on Conservation and sustainable development' in

connection with CSIR ‘One week One lab’ programme, at NBRI Lucknow, on 16 August 2023.

10. Dr. Radha, R. K. has attended the Technical Committee Meeting (Scrutiny of Research Projects) of Chhattisgarh State Medicinal Plant Board at SMPB, Chhattisgarh, on 26 September 2023.
11. Dr. Radha, R. K. has presented the First Year Report before 1<sup>st</sup> Technical and Financial Committee on Environmental Research and Developmental Program meeting for Research and Development, held on 12 October 2023 under the Chairmanship of Dr. Ruplal (Dept.of Zoology, University of Delhi) at MoEF & CC office, New Delhi.
12. Dr. Radha, R. K. has presented through video conferencing, the 2<sup>nd</sup> Year Progress Report of NMPB Project before the 79<sup>th</sup> meeting of the Project Screening Committee for Research and Development, held on 18 May 2023 under the Chairmanship of Dr. Suresh Kumar Malhotra, Director, Directorate of Knowledge Management in Agriculture (ICAR), Minister of Agriculture & Farmers Welfare, New Delhi.
13. Dr. Saleem, M. has evaluated a project entitled ‘Development of Novel Hybrids Orchids’ submitted by Dr. Resmi Paul, Kerala Agriculture University, as part of Science Research Scheme of KSCSTE.
14. Dr. Vinodkumar T. G. Nair has attended the KUHS-Meeting (online) of School Board for School of Fundamental Research in Ayurveda on 4 August 2023.
15. Dr. Vinodkumar T. G. Nair has been selected as subject expert to frame the guidelines, MSR & MSE for Guru Shishya Parampara BAMS course, by the National Commission for Indian Systems of Medicine, Ministry of AYUSH, Government of India on 10 May 2023 and 18 to 19 May 2023 at New Delhi.

## **DEMONSTRATION CLASSES & FIELD ORIENTATION PROGRAMMES**

- Dr. Abdul Jabbar, M. has given a demonstration class for 12<sup>th</sup> batch Section Forest Officer trainees of State Forest Training Institute, Arippa on 21 March 2024.
- Dr. Abdul Jabbar, M. has given a demonstration class for the Range Forest Officer Trainee Batch, PTP Nagar, Thiruvananthapuram on 20 January 2024.

- Dr. Abdul Jabbar, M. has managed the field visit for the faculties of DBT Skill Vigyan Refresher Course at Medicinal Garden, JNTBGRI and a field trip to Ponmudi forest areas on 16 January 2024 and 27 January 2024 respectively.
- Dr. Abdul Jabbar, M. has managed the field visit for the participants of *Karyashala* Programme organized by Science Engineering Research Board, Govt. of India on 13 March 2024 at JNTBGRI.
- Dr. Anilkumar, C. has conducted a one-day workshop on the topic “Conservation through knowledge of native medicinal plant seeds and seedlings” on 18 October 2023 at KSCSTE- JNTBGRI with the financial support of the Kerala State Biodiversity Board. Teachers and students at Government High School Jawahar Coloney and Crescent Central School Peringammala as 50 participants were assembled at the Seminar Hall of the Institute’s Visitors Management Centre.
- Dr. Anurag Dhyani has participated (online) as Keynote speaker at the 7<sup>th</sup> International Symposium of the Philippine Native Plant Conservation Society and delivered a talk on ‘Seed Conservation of IUCN Threatened Species’ at North-Western University in Laoag, Ilocos Norte, Philippines, 16-17 November 2023.
- Dr. Abdul Jabbar, M. has given awareness classes on medicinal plants to 9 students of M.D (Siddha) Gunapadam (Pharmacology) Department, National Institute of Siddha, Chennai when they visited JNTBGRI on 31 October 2023.
- Dr. Abdul Jabbar, M. has given awareness classes to the students who participated in the workshop on ‘Conservation through Knowledge on Native Medicinal Plant Seeds and Seedlings’ at JNTBGRI on 18 October 2023.
- Dr. Anilkumar, C. and P. S. Jothish have given awareness classes to the students who have participated in the workshop on ‘Conservation through Knowledge on Native Medicinal Plant Seeds and Seedlings’ at JNTBGRI on 18 October 2023.
- The Biotechnology and Bioinformatics Division has conducted a one day training programme on Bioinformatics to PG Biotechnology students (40 students) and three faculties namely Dr. Kiranraj, Dr. Ratheesh & Neethu Jayakumar of Sree Narayana College, Kollam on 4<sup>th</sup> August, 2023.
- The Biotechnology and Bioinformatics Division has given one month internship training on ‘A database on selected anti-snake venom plants and preparation of its herbarium’ to three B.Sc. Botany students (Ajna, N. S., Aswani, A. S. and Farhana, L.) from A. J. College, Thonnikkal, Thiruvananthapuram in January 2023.

- The Biotechnology and Bioinformatics Division has given one month internship training on “Plant Tissue Culture” to eight students (A. Anisha, W. Biniya Joshila, R. Ishwarya, J. Jainab Meera, P. Jeya Arockia Anusha, M. Manisha, A. M. Rocklin Binoshia and D. Sahaya Felcia) from the Department of Botany, Holy Cross College (Autonomous), Nagercoil, in December 2023.
- The Biotechnology and Bioinformatics Division has given one month internship training on ‘Common Medicinal Plants in Kerala’ to four B. Sc. Botany students (Agranka S Madhav, Akash, S, Harikeerthi, S. S. and Sandra Joseph) from A. J. College, Thonnakkal, Thiruvananthapuram in January 2023.
- The Biotechnology and Bioinformatics Division has given one month internship training on ‘Cell cycle analysis using onion root tip and Tradescantia spathacea (Rheo) flower buds to four B.Sc. Botany students (Anitha, A. S., Harikrishnan, G. R., Muhsina Noushad and Priyanka Suresh) from A. J. College, Thonnakkal, Thiruvananthapuram in January 2023.
- The Biotechnology and Bioinformatics Division has provided one month internship training in Bioinformatics to three M. Sc. Biotechnology students (Rangasri, M., Sabeetha, S., Jemeena, J.) from Mother Teresa Women's University, Kodaikanal, Tamil Nadu, during the month of December 2023.
- The Biotechnology and Bioinformatics Division has provided three weeks training (from 5 to 27 June 2023) in molecular docking to Ms. Greeshma, S., M. Sc. Biotechnology, Hindustan College of Arts and Science, Chennai.
- The Biotechnology and Bioinformatics Division has provided two weeks training (from 17 April 2024 to 4 May 2024) to Ms. Ravethy, V., B.Sc. Botany and Biotechnology student from Govt. College, Kariyavattom.
- Conducted a workshop with financial support from KSCSTE-MoEF-EEP Kerala - Students Lifestyle workshop for School students under National Green Crops on January 11, 16 & 29, 2024 and February 2, 2024. A total of 200 students and teachers of four schools in the Thiruvananthapuram District were participated in the training.
- JNTBGRI and BRC Palode has facilitated, as part of Sarva Shiksha Abhiyan, “Universal Elementary Education to all Children” programme, an outdoor day for differently abled bed-ridden children on 14 November 2023.

- Five teaching faculty members, 3 Postgraduate, 115 Undergraduate students from Sushrutha Ayurvedic Medical College & Hospital, Bengaluru (SAMCH, Bengaluru) were given training on 30 November 2023.
- Dr. Abdul Jabbar, M. gave demonstration classes for 45 trainees and 2 faculties of the Forest Range Officer trainees (2022-24 (IX) Batch from Tamil Nadu Forest Academy, Coimbatore, on 28 May 2023 as part of their Induction Training Course.
- Dr. Abdul Jabbar gave demonstration classes for 43 trainees and 2 faculties of the Forest Range Officer trainees batch (2022-24) of Kundal Academy of Development, Administration and Management, Maharashtra on 29 November 2023.
- Two faculty members and 57 Forest Range Officer's trainee batch (2023-24) of PTI, Uttarakhand Forest Training Academy, Haldwani were given training on 13 December 2023.
- French students from the 'Ecole France Ayurveda - Gaya Veda Academy' were given training on 26<sup>th</sup> November 2023.
- Dr. Mathew Dan and M. Saleem have visited KFD Orchid Conservatory at Wagamon on request and had discussions with the officials regarding the improvement of the conservatory and provided training to three staff at JNTBGRI on Orchid management.
- Dr. Rajendraprasad, M. has attended as an invitee for panel discussion in the Kerala Literary Festival held at Kozhikode held during 11 - 14 January 2024.
- Dr. Raveendran, M. has completed an online training on Empowering Plant Biotechnologists: Mastering CRISPR-Cas9 Mediated Editing for Precision Genetic Manipulation in Plants Centre for Plant Biotechnology and Molecular Biology, KAU, on 30.09.2023.
- Remya, R. P., Biotechnology & Bioinformatics Division has successfully completed four days international workshop on Advanced Dynamics Simulation hosted by BiogenecodeX during 26-29 February 2024.
- Dr. Vinodkumar T. G. Nair has been invited to make a presentation on AYUSH Project in the 8th Ayurveda day celebrations coordinated by Kerala Biotechnology Commission & KSCSTE at KSCSTE, Sasthra Bhavan, Thiruvananthapuram on 10 November 2023.
- Dr. Vinodkumar T. G. Nair has been invited to present and participate as a subject expert in the online interactive session with the students of GOHS Edathanattukara, Vattamannappuram, Palakkad as part of the Environment Day celebration - 2023 on 5 June 2023.

- Dr. Vinodkumar T. G. Nair has attended the online meeting of the 4th Project Appraisal Committee organized by the Ministry of AYUSH, Govt. of India, on 22 November 2023.
- Dr. Abdul Jabbar, M. has given demonstration classes to Beat Forest Officer Trainees from the State Forest Training Institute, Arippa, in four batches on the 13<sup>th</sup>, 15<sup>th</sup>, 19<sup>th</sup> and 29<sup>th</sup> September 2023.
- Dr. Abdul Jabbar, M. has given demonstration classes for five batches of Beat Forest Officer SR Trainees, KEPA, Thrissur, Kerala Forest Department on 23<sup>rd</sup> and 27<sup>th</sup> June, 22<sup>nd</sup> August, 18<sup>th</sup> September and 20<sup>th</sup> October 2023.
- Forest Range Officer's trainee batch (2022-24) of Kundal Academy of Development, Administration and Management, Maharashtra were given training on 29 November 2023.
- One day orientation programme has been arranged for the newly recruited thirteen scientists from KSCSTE, on 12 September 2023.



Newly recruited scientists from KSCSTE R&D centres at JNTBGRI, attending the orientation programme.

## CONSULTATION PROGRAMMES

- Dr. M. Rajendraprasad has attended consultative meetings of Govt. programme Freedom Fest 2023 on 30 December 2023 at the office of the State Lottery, Gorkhi Bhavan, Thiruvananthapuram.
- Dr. M. Rajendraprasad has supervised the Green Mission activities of Mar Thoma College, Thiruvalla and certified the Green Audit Report for the period 2022-2023 academic year.
- Dr. M. Rajendraprasad has supervised the Green Mission Initiatives of Iqbal College, Peringammala and certified Green Audit Report for the period 2022-2023 academic year.
- Dr. Radha, R. K. became a Jury Member in the Panel of Biodiversity Awards - KSBB, Govt. of Kerala (February 2024).
- Dr. Radha, R. K. becomes an expert member in the Interview Board - New Innovation award for PG students, KSBB, Govt. of Kerala.
- Dr. Sreekumar, S. has been selected as a member in the Human and Animal Ethical Committee of AYUSH Department (GO(Ms) N0.11/2023/AYUSH, dtd.11-08-2023 and subsequently, the Director AYUSH Homoeopathy Department Order No. DHTVM/I807/2022/P2, dated: 13-09-2023 has assigned his role as Scientific expert in IEC.
- Established a Herbal Garden at Christ Nagar College, Maranalloor, as part of a consultancy programme.

## POPULAR ARTICLES

1. Bindu, S. and C. Anilkumar, 2023. *Sarpagandhi*. Aaranyam, Forestry Information Bureau, Kerala Forest Department 44 (2): 17-18.
2. Mathew Dan and M. Abdul Jabbar, 2023. *Oushada Gunamulla Visha Sasyangal*. Aranyam, Forestry Information Bureau, Kerala Forest Department 44 (2): 30-33.
3. Gopakumar, B., Dhyani, A. and M. Dan, 2023. Seed storage: a low-cost solution for *Ochlandra* bamboo species. Samara- The International Newsletter of the Millennium Seed Bank Partnership, Royal Botanic Gardens Kew 39: 6.

4. Govind, M. G., Mathew Dan and K. B. Ramesh Kumar, 2023. *Paschimaghata vanangalile jathi vrikshangal*. Aranyam, Forestry Information Bureau, Kerala Forest Department 43 (5): 20-23.
5. Abdul Jabbar, M., Anurag Dhyani and Mathew Dan, 2023. Nurturing nature's wisdom: JNTBGRI garden's bridge for forest official. *Roots* 20 (2): 16-19.
6. Jothish, P. S. and C. Anilkumar, 2023. *Silent Valleyude Swantham Neeraal*. Aranyam, Forestry Information Bureau, Kerala Forest Department 44 (4): 36-38.
7. Nazarudeen, A., 2023. *Choodamaram: Kuttalam Kunnile Pythrika Maram*. Aranyam, Forestry Information Bureau, Kerala Forest Department 43 (11): 38-39.
8. Nazarudeen A., 2023. *Kanyavanagalile Kattupazhangal*. Aranyam, Forestry Information Bureau, Kerala Forest Department 43 (5): 11-15.
9. Nazarudeen, A., 2024. *Nakshathrangal Neerattinirangumbol*. Aranyam, Forestry Information Bureau, Kerala Forest Department, 44 (6): 39.
10. Rajkumar, G., 2023. *Vishamaya Vrikshangal: Othalam, Kanjiram*. Aranyam, Forestry Information Bureau, Kerala Forest Department 44 (2): 19.
11. Rameshkumar, K. B., 2023. *Paala Pookkum Raavukal*. Aranyam, Forestry Information Bureau, Kerala Forest Department 44 (4): 12-15.
12. Rameshkumar, K. B., 2023. *Pachimaghatta vanangalile jaathi vrikshangal*. Aranyam, Forestry Information Bureau, Kerala Forest Department 43 (5): 20-23.
13. Rameshkumar, K. B., 2023. *Pachimaghatta vanameghalayile Sugandha vrikshangal*. Aranyam, Forestry Information Bureau, Kerala Forest Department 43 (5): 16-19.
14. Rameshkumar, K. B., 2023. *Visha sasyngalile visharaasa ghadakangal*. Aranyam, Forestry Information Bureau, Kerala Forest Department 44 (2): 14-16.
15. Sabu, T., 2023. *Fibre Yielding Trees in Kerala*. Aranyam, Forestry Information Bureau, Kerala Forest Department 43 (5): 41-43.
16. Sakthipriya, M. and K. K. Sabu, 2024. *History milestones of insulin*. *Sasthra*. Vol. 5, No. 1.

17. Santhosh Kumar, E. S. and S. M. Shareef 2023. *Kuriji Vasanthathil Ponmudi Malanirakal*. Aranyam, Forestry Information Bureau, Kerala Forest Department 44 (2): 24-25.

## **PATENTS GRANTED**

### **Indian Patent**

1. Rajasekharan, S., Latha, P. G., Suja S. R. and Ragesh R. Nair. Herbal drug composition possessing multiple therapeutic effects (*Tetracera akara*). Application No. 201641010849 Application No. 201641010849. Indian patent granted 27 April 2023.
2. Rajasekharan, S., Latha, P. G., Suja, S. R., Siril, E. A., Aneesh Kumar, A. L., and R. Prakashkumar. Novel single herbal drug formulation possessing multiple therapeutic effects as wound healing, burn healing, anti-cancer, analgesic, anti-inflammatory, immuno enhancing, platelet augmentation and antioxidant. Appl No. 5667/CHE/2014. Indian patent granted, 22 February 2023.

## **VIP VISITS**

1. Prof. Jim Godfrey (Former Board Member, ICRISAT) and Chairman (Rtd.), National Institute of Agricultural Botany (NIAB), Cambridge, UK has visited JNTBGRI on 29 April 2023.
2. Prof. James Hanken from Harvard University visited JNTBGRI on 13 June 2023.
3. Dr. Ethan Freid, Botanist, Bahamas National Trust, Eleuthera.
4. Mr. Aby Joseph, Assistant Professor and Forensic DNA Consultant, Amity University, Dubai visited JNTBGRI on 3 August 2023.
5. Dr. S. D. Biju from Delhi University visited JNTBGRI on 13 June 2023.
6. Padmasree Lekshmikutty Amma, the tribal healer who received the India's fourth highest civilian honour Padma Shri and practicing traditional medicine for over 50 years has visited JNTBGRI on 16 May 2023.
7. Padmashri Dr. P. Pushpangadan, former Director, JNTBGRI & NBRI.
8. Mr. Binoy Vishwam, Rajyasabha MP has visited JNTBGRI on 1 June 2023.

## **AWARDS/ HONOURS/ RECOGNITIONS**

- Aswathy, J., DST INSPIRE SRF, Phytochemistry and Phytopharmacology Division, JNTBGRI bagged the First Prize in the Prof. A. Abraham Memorial Contest, 2023 at JNTBGRI on 16 June 2023.
- Dr. Anurag Dhyani has been selected as Member, Bamboo Phylogeny Group II, China.
- Dr. Anurag Dhyani received New Phytologist Foundation Annual Editorial Grant to support Plant Science Research and Teaching, supported by The New Phytologist Foundation, Lancaster, United Kingdom.
- Dr. Anurag Dhyani, Scientist, Conservation Biology Division has become the Member of the British Ecological Society Review College, UK.
- Dr. Joemon Jacob has received the special Jury Award in the Prof. A. Abraham Best Annual Achievement Award competition 2023 at JNTBGRI on 16 June 2023.
- Dr. K. B. Rameshkumar has received the Fellowship of the Kerala Academy of Sciences (FAS).
- Dr. M. Saleem, Technical Officer, received ‘Prof. A. Abraham Best Annual Achievement Award 2023’, on 16 June 2023 at JNTBGRI.
- Dr. Mathew Dan won best Oral Presentation award (Second position) in the technical session I at Conference on Spices, Aromatic and Medicinal Plants for Economic Prosperity and Ecological Sustainability 2023, organized by the Andaman Science Association at ICAR in the Central Island Agricultural Research Institute, Port Blair during 5-6 October 2023.
- Dr. Radha, R. K. received SPG award - SPG, SERB, DST, Govt. of India, PG- Serb Power Grant (Award for eminent women researchers for an individual-centric and competitive mode of research funding to undertake R & D activities).
- Dr. Raju Antony, Technical Officer is honoured with ‘Prof. S. S. Bir Medal in Pteridology’ by The Indian Fern Society, for his excellent achievements in the field of Pteridological Research.
- Dr. Saleem, M. Technical Officer, PGR Division has bagged the Prof. A. Abraham Best Annual Achievement Award 2023 at JNTBGRI on 16 June 2023.
- Dr. Suja, S. R. has been nominated as an external examiner for CSIR-SRF upgradation committee of the candidate Aswathy CSIR Fellow, Student of Dr. Kumaran from CSIR NIIST on 16 February 2024 (online mode).

- Dr. Suja, S. R. has been nominated as an external examiner for CSIR-SRF upgradation committee of the candidate Ms. Gopika Biju, CSIR Fellow, Student of Dr. Kumaran from CSIR NIIST on 26 March 2024 (online mode).
- Dr. V. Gayathri has bagged the Best Women Researcher Award in the International Conference on Advances in Bioresearch, during 26 to 27 July 2023, held in Thiruvananthapuram.
- Dr. Vinodkumar T. G. Nair, Senior Scientist was invited and attended the online meeting of KUHS-Meeting of School Board for School of Fundamental Research in Ayurveda on 4 August 2023.
- Dr. Vinodkumar T. G. Nair, Senior Scientist, JNTBGRI has been nominated as a member in the Senate of the University of Kerala by the Vice Chancellor, on 1 December 2023.
- JNTBGRI bagged First place in Flower arrangement competition in Orchid show at Punjab University, Chandigarh in connection with the Orchid Society of India Conference during 3-5 March 2023.
- JNTBGRI bagged the award consecutively for the third time the Global Genome Initiative for Gardens (GGI-Gardens) Award 2024 instituted jointly by GGI-Gardens, BGCI-US and USBG for the collection and conservation of plant diversity.
- JNTBGRI has received the Global Genome Initiative for Gardens (GGI-Gardens) Award in 2023.
- Keerthi Sugathan CSIR-SRF won the Best paper award at the 15<sup>th</sup> International Conference on Agriculture and Horticulture and Plant Science 2023. The conference was organized by the Society of Tropical Agriculture, to be held during 24-25 June 2023 in Delhi. The topic chosen for presentation was “*In silico* evaluation of the anti-SARS-CoV-2 activity on bael tree (*Aegle marmelos* L.).
- Keerthi Sugathan CSIR-SRF won the best poster presentation award at the International Conference on Advances in Bioresearch held in Thiruvananthapuram during 26-27 July 2023. The topic chosen for the poster contest was “Phytochemicals with SARS-CoV-2 multiple targeting potential in *Ananas comosus* (L.) Merr., an *in-silico* approach”.
- Keerthi Sugathan CSIR-SRF won the best poster presentation award at the International Conference on Recent Advances in Biological Science 2023 on the topic “*In silico* identification of multi-target inhibitors against SARS-CoV-2 from *Tamarindus indica* L.”, organized by Inter University Centre for Evolutionary and Integrative Biology (ICEIB)

University of Kerala during 17-19 January 2023.

- Keerthi Sugathan CSIR-SRF won the Best Student Researcher award at the International Conference on Advances in Bioresearch held in Thiruvananthapuram during 26-27 July 2023.
- Nayana, P. K., Microbiology Division has bagged the 3<sup>rd</sup> prize in the Prof. A. Abraham Memorial Contest, 2023 at JNTBGRI on 16 June 2023.
- Rahul Jose, JRF, Conservation Biology Division has bagged the 2<sup>nd</sup> prize in the Prof. A. Abraham Memorial Contest, 2023 at JNTBGRI on 16 June 2023.



Prof. A. Abraham Memorial Programme, 16 June 2023. Padma Shri M. C. Dathan, Dr. C. Satheesh Kumar and Dr. B. Sabulal on the dais.



Dr. M. Saleem, Technical Officer, PGR Division receives Prof. A. Abraham Best Annual Achievement Award 2023 from Padma Sri M. C. Dathan, on 16 June 2023.



Aswathy, J. DST INSPIRE SRF receives the best paper presentation award from Padma Shri. M. C. Dathan during Prof. A. Abraham Memorial Award Contest 2023, JNTBGRI, 16 June 2023.



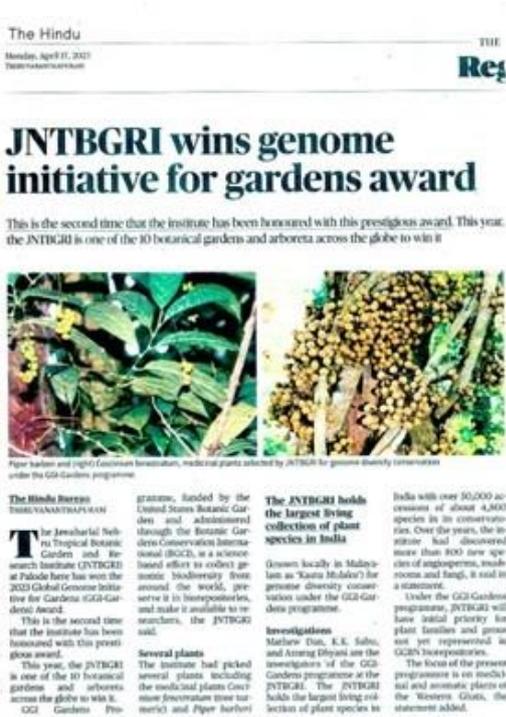
Dr. Raju Antony, Technical Officer honoured with ‘Prof. S. S. Bir Medal in Pteridology’ by The Indian Fern Society, for his excellent achievements in the field of Pteridological Research.



Dr. Mathew Dan, Principal Scientist, Plant Genetic Resources Division, JNTBGRI wins the best oral presentation award in the event of the Conference on Spices, Aromatic and Medicinal Plants for Economic Prosperity and Ecological Sustainability-2023, organized by the Andaman Science Association at ICAR in the Central Island Agricultural Research Institute, Port Blair on 6 October 2023.

**MEDIA REPORTS/NEWS/BROADCASTINGS**

- Newspaper Report: “*Anyam ninnukondirikkunna sasya-janthu jalangale ariyan padana sankham kadalorath*”. **Suprabhaatham daily**, Malappuram ed. 17 March 2024, [www.epaper.suprabhaatham.com](http://www.epaper.suprabhaatham.com).
- **The Hindu daily** published ‘JNTBGRI wins Genome Initiative for Gardens Award’, on 17 April 2023.
- **Kerala Kaumudi** daily has published a report on 26 July 2023, on the flowering of the Tiger Orchid in the title ‘ടെഗർ ഓർക്കിഡിന്റെ മനോഹാരിതയിൽ ബൊട്ടാണിക്കൽ ഗാർഡൻ’.
- **The Hindudaily** has published a report on 26 February 2024, on the Andaman Plant Collections at JNTBGRI, under the title ‘Biorepository for Andaman and Nicobar flora to come upon JNTBGRI campus in Palode’.
- **The Hindu daily** has published a report ‘GGI-Garden’s Award’ on 16 February 2024.



# Jawaharlal Nehru Tropical Botanic Garden and Research Institute to set up biorepository for Andaman flora

Published / Updated - February 27, 2024 11:30 IST

TIKIRAJWI



The entrance to the Field Conservatory of Andaman and Nicobar Plants at the JNTBGRI, Palode. | Photo Credit:



Listen to article

Stately-looking trees tower over the dense undergrowth of bushes and shrubs. Thick-stemmed lianas hang, snake-like, from low branches. For all that, to the casual observer, it could be just another wooded area.

Botanists would be quick to dispel the notion. The plant species in this sylvan location at Palode are, for the most part, extremely rare non-natives.

## പുതുമകളുടെ ബോട്ടാണിക്കൽ സർവേ റിപ്പോർട്ട്

എൻ.എൻ. രാമേശ്കുമാർ

**ലോ**കത്തെപ്പറ്റി പലരും അറിയുന്നില്ല. ഇന്ത്യയിലെ പല ഭാഗങ്ങളിലും പുതുമകളുടെ ബോട്ടാണിക്കൽ സർവ്വേ നടന്നു. ഇന്ത്യയിലെ പല ഭാഗങ്ങളിലും പുതുമകളുടെ ബോട്ടാണിക്കൽ സർവ്വേ നടന്നു. ഇന്ത്യയിലെ പല ഭാഗങ്ങളിലും പുതുമകളുടെ ബോട്ടാണിക്കൽ സർവ്വേ നടന്നു.



**സമീപകാലം**

ഇന്ത്യയിലെ പല ഭാഗങ്ങളിലും പുതുമകളുടെ ബോട്ടാണിക്കൽ സർവ്വേ നടന്നു. ഇന്ത്യയിലെ പല ഭാഗങ്ങളിലും പുതുമകളുടെ ബോട്ടാണിക്കൽ സർവ്വേ നടന്നു.

ഇന്ത്യയിലെ പല ഭാഗങ്ങളിലും പുതുമകളുടെ ബോട്ടാണിക്കൽ സർവ്വേ നടന്നു. ഇന്ത്യയിലെ പല ഭാഗങ്ങളിലും പുതുമകളുടെ ബോട്ടാണിക്കൽ സർവ്വേ നടന്നു.

**കേരളത്തിലെ**

കേരളത്തിലെ പല ഭാഗങ്ങളിലും പുതുമകളുടെ ബോട്ടാണിക്കൽ സർവ്വേ നടന്നു. ഇന്ത്യയിലെ പല ഭാഗങ്ങളിലും പുതുമകളുടെ ബോട്ടാണിക്കൽ സർവ്വേ നടന്നു.

കേരളത്തിലെ പല ഭാഗങ്ങളിലും പുതുമകളുടെ ബോട്ടാണിക്കൽ സർവ്വേ നടന്നു. ഇന്ത്യയിലെ പല ഭാഗങ്ങളിലും പുതുമകളുടെ ബോട്ടാണിക്കൽ സർവ്വേ നടന്നു.

**പുതുമകളുടെ**

പുതുമകളുടെ ബോട്ടാണിക്കൽ സർവ്വേ നടന്നു. ഇന്ത്യയിലെ പല ഭാഗങ്ങളിലും പുതുമകളുടെ ബോട്ടാണിക്കൽ സർവ്വേ നടന്നു.

പുതുമകളുടെ ബോട്ടാണിക്കൽ സർവ്വേ നടന്നു. ഇന്ത്യയിലെ പല ഭാഗങ്ങളിലും പുതുമകളുടെ ബോട്ടാണിക്കൽ സർവ്വേ നടന്നു.

## RADIO TALKS

1. **Akashvani, Kannur** station has broadcasted a talk by Dr. Mathew Dan, titled 'Wild relatives of Spice Crops in the Western Ghats' on 17 May 2023.
2. **Akashvani, Thiruvananthapuram** station has broadcasted a programme on the garden activities of JNTBGRI on 2 October 2023.
3. **All India Radio, Kannur** station has broadcasted a talk by Dr. Mathew Dan on the 'Significance of Botanic Gardens' and Dr. M. Saleem on 'Carnivorous Plants' in the Science Cafe Program on 28 November 2023.
4. Dr. K. B. Rameshkumar has made a chat on Petrichor in the **Club FM**, Thiruvananthapuram on 5 February 2024.
5. Dr. K. B. Rameshkumar has made a chat on *Alstonia* flowering in the **Club FM**, Thiruvananthapuram on 26 December 2023.
6. Dr. K. B. Rameshkumar has made a chat on Cats paw flowering in the **Club FM**, Thiruvananthapuram on 10 May 2023.
7. Dr. Vinodkumar T. G. Nair, Senior Scientist has delivered an invited talk on the topic,

“Environment and Health” for the programme, **Harithvani** telecasted by **Akashvani, Thiruvananthapuram** on 13 October 2023 and the programme was broadcasted on 24 October 2023, at 9.00 am.

## VIDEO PROGRAMME

1. **News 18 Channel** has made a video documentary on the activities of the PGR division, on 18 October 2023.

## PROJECT REPORTS AND PRESENTATIONS

1. The Progress Report (hard copy) of the Second phase (December 2019 - November 2021) of the project, ‘Systematic Documentation of Traditional Knowledge related to plants used for food, AYUSH and indigenous medicine’, funded by the Ministry of AYUSH, Government of India was prepared covering all the approved deliverables by Dr. Vinodkumar T. G. Nair, PI assisted by Ms. Saranya Mol, S. T., JPF and printed in 3 volumes with 1477 pages. The Progress report with 11 enclosures/documents including 2 copies of peer reviewed UGC approved biannual journal, *Journal of Traditional and Folk Practices* (Vol. 7 (1 & 2) & 8 (1) June 2020 and Vol. 8 (2) December 2020) were submitted to the Executive Vice President, KSCSTE on 26 April 2023 and sent to the Ministry of AYUSH, Government of India on 5 May 2023.
2. The soft copies of the Progress Report & 11 enclosures of the Phase II (December 2019 - November 2021) of the project, 'Systematic Documentation of Traditional Knowledge related to Plants used for Food, AYUSH and Indigenous Medicine, as requested were submitted to The Under Secretary, Ministry of AYUSH, GoI through e-mail on 29 May 2023.
3. Dr. Vinodkumar T G Nair, Senior Scientist, Ethnomedicine and Ethnopharmacology Division & PI has attended and presented as PPT before the Project Appraisal Committee (PAC) chaired by The Special Secretary, Ministry of AYUSH, Government of India about the status of the second phase of the ongoing CoE project, ‘Systematic Documentation of Traditional Knowledge related to plants used for food, AYUSH and indigenous medicine’, funded by the Ministry of AYUSH, GoI. The meeting was held at AYUSH Bhawan, Ministry of AUSH, New Delhi on 13 June 2023. In the meeting, Utilization Certificate and Statement of Expenditure of the 2<sup>nd</sup> instalment of the project were also submitted.

## EXTRA ASSIGNMENTS/ MEETINGS/TALKS ATTENDED

- Dr. Abdul Jabbar has delivered a talk on 'Biodiversity and climate change' in the Seminar organized by Dr. Kamarudeen Foundation for Biodiversity Conservation at Iqbal College, Peringammala on 15<sup>th</sup> November 2023.
- Dr. Anilkumar, C. as Mentor, has participated in the project review meeting of DST women scientist programme of Mrs. Angala Mathew on the project entitled 'Nutritional analysis and development of nutraceuticals/ food supplements based on 'Arogyapacha' (*Trichopus zeylanicus* subsp. *travancoricus* Burkill ex K. Narayanan): an ethnomedically important plant' on 27<sup>th</sup> June 2023.
- Dr. Anilkumar, C. has chaired an online Ph.D. Open Defense of Mrs. Neha C P, Research Scholar of Kannur University on 11<sup>th</sup> March 2023, at 1.30 am. (No. RDC/B2/2/2023 (II) dated 01-04-2023).
- Dr. Joemon Jacob has given a lecture on Palmetum to Beat Officer Trainees on 19/06/2023.
- Dr. Mathew Dan has made a presentation on the topic "Characterization of Raw Drugs for Quality Assurance" on 27<sup>th</sup> April 2023, in the webinar series "Empowerment of Ayurvedic and Herbal Industry in Kerala" organized by Care Keralam, Cochin.
- Dr. Mathew Dan, 2023. participated in a project discussion meeting with State Medicinal Plant Board of Chattisgarh, 25-27 September 2023 at Raipur, along with the Member Secretary and other officials from KSCSTE Institutions.
- Dr. Mathew Dan, 2023. served as a panelist on 'Plant Taxonomy and Biodiversity: cross-sectoral linkages & impacts on Conservation and sustainable development" in connection with CSIR 'One week one lab" programme, at NBRI Lucknow on 16<sup>th</sup> August 2023.
- Dr. Sabu, T. has attended the Carbon Neutral Kattakkada' Project evaluation meeting on 21 June 2023 (Panchayat Association Hall, Vellayambalam).
- Dr. Saleem, M. has served as a resource person in the training for officials from Vegetable and Fruit Promotion Council (VFCK) and Kerala State Horticulture Mission at KVK Mithra Nikethan, Thiruvananthapuram on 3 November 2023.

- Dr. Saleem, M. has served as resource person for the training of officials from Vegetable and Fruit Promotion Council (VFCK) and Kerala and State Horticulture Mission conducted by VFCK at IMG, Kozhikkode, on 7 December 2023.
- Scientists of JNTBGRI have participated evaluation of activities for Carbon neutral Kattakkada Programme held at land use board seminar hall on 26 April 2023.
- Dr. Vinodkumar T. G. Nair, Senior Scientist, Ethnomedicine and Ethnopharmacology Division has been invited as a subject expert to frame the guidelines, MSR & MSE for Guru Shishya Parampara BAMS course, by the National Commission for Indian Systems of Medicine, Ministry of AYUSH, Government of India on 10 May 2023 and 18 - 19 May 2023, in New Delhi.
- Dr. Vinodkumar T. G. Nair, Senior Scientist, Ethnomedicine and Ethnopharmacology Division has delivered an invited talk on the topic '*Owshadha sasyangalum ayurvedavum*' in the programme, *Sasthra Sameeksha - 2023*, a science orientation programme conducted for school students organized by KSCSTE - JNTBGRI, Palode from 22 - 26 May 2023.
- Dr. Vinodkumar T. G. Nair, Senior Scientist, Ethnomedicine and Ethnopharmacology Division has been invited to present and participate as a subject expert in the online interactive session with the students of GOHS Edathanattukara, Vattamannappuram, Palakkad as part of the Environment Day celebration - 2023, on 5 June 2023.

## RETIREMENTS

- Dr. Mathew Dan, Principal Scientist & HoD, PGR Division has superannuated on 30 November 2023.
- Mr. Radhikamma B., Gardener, Garden Management Division has completed her 5-year deputation period and joined back in her mother department at Museum, Thiruvananthapuram.
- Mr. Shaji P., Gardener, PGR Division has superannuated on 31<sup>st</sup> May 2023.
- Dr. Sreekala A. K., Principal Scientist, Conservation Biology Division has superannuated on 31 July 2023.
- Mr. Sudharsanan C., Gardener, Garden Management Division has retired on 31/05/2023.
- Dr. William Decruse, Principal Scientist & HoD, Biotechnology and Bioinformatics Division has superannuated from service on 31 July 2023.



Dr. Mathew Dan



Dr. William Decruse



Dr. A.K. Sreekala

### PLAN FUNDED RESEARCH AND INFRASTRUCTURE PROGRAMMES

SN	CODE	PROJECT NAME	DIVISION
1	P-001	1) <i>Ex situ</i> Conservation and Sustainable Utilization of Selected	Biotechnology & Bioinformatics

		Plant Genetic Resources in the Southern Western Ghats through the invention of Biotechnology and Bioinformatics. 2) Analysis of species distribution and reinforcement of two threatened trees in the Kerala region of the Western Ghats for the improvement of their conservation status.	
2	P-002	Studies on conservation biological aspects of selected flowering plant wealth of Kerala.	Conservation Biology
3	P-003	Systematic documentation and bioprospecting of ethnomedically important medicinal plants based on tribal/ traditional knowledge through molecular pharmacological approach.	Ethnopharmacology & Ethnomedicine
4	P-004	Development and Upkeep of Germplasm Conservatories and Landscapes & Dissemination of Botanical knowledge.	Garden Management, Education, Information and Training.
5	P-04B	Sustainable Utilization of Medicinal, Aromatic and Other Potential Economic Plants of the Kerala Region of Western Ghats Through Phytochemical and Pharmacological Means.	Phytochemistry and Phytopharmacology
6	P-04C	Scientific Infrastructure and Central Instrumentation Facility.	Phytochemistry and Phytopharmacology
7	P-005	Survey, Inventory, Bioprospecting and Sustainable Utilization of Mushroom, Microbial & Lichen Diversity of Western Ghats.	Microbiology
8	P-006	Germplasm Conservation, Conventional & Non-Conventional Multiplication, Maintenance and Sustainable Utilization of Medicinal, Orchids, Bamboo, Carnivorous Plants, Butterfly Garden and Crop Related plants from Western Ghats and Andaman / Nicobar Islands.	Plant Genetic Resources

9	P-007	Sustainable utilization of medicinal, aromatic and other potential economic plants of the Kerala region of Western Ghats through phytochemical and pharmacological means.	Phytochemistry & Phytopharmacology
10	P-008	Germplasm Conservation, Conventional & Non-Conventional Multiplication, Maintenance and Sustainable Utilization of Medicinal, Aromatic, Orchid, Anthurium, Bamboo and Crop Related plants from Western Ghats and Andaman / Nicobar Islands.	Plant Genetic Resource
11	P-009	Survey, Exploration and Documentation of Floristic wealth of Kerala & Assessment of Ecosystem Services.	Plant Systematics & Evolutionary Science
12	P-10	Inventory, documentation and phylogenetic studies of mushrooms of Western Ghats & Establishment of a regional reference centre for mushrooms.	Microbiology
13		Assessment of Translational potential of a novel mTOR inhibitor for Colon cancer treatment.	Microbiology
14	P-11	Establishment of STEC-JNTBGRI as a nodal Centre for multidisciplinary research, production and supply of quality seeds, large scale cultivation of high value ornamental plants and human resource development.	Biotechnology & Bioinformatics
15	P-12	Integrated R & D Centre of JNTBGRI - An extension of the Screw pine Tissue culture project at Kuzhur, Kodungalloor.	Biotechnology & Bioinformatics
16	P-13	Improvement of Existing Landscape and Field Gene Bank.	JNTBGRI
17	P-13B	Scientific Infrastructure and Central Instrumentation Facility.	Phytochemistry & Phytopharmacology
18	P-14	Central Instrumentation Facility.	JNTBGRI
19	P-15	JNTBGRI Infrastructure Programmes.	JNTBGRI
20	P-16	Development of a comprehensive	Biotechnology & Bioinformatics

	database on achievements of JNTBGRI Bioinformatics.	
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### EXTERNALLY FUNDED PROGRAMMES

No.	Project Code	Title of the project	Principal Investigator
1	A-19	Establishment of Sub-Distributed Information centre at TBGRI under Bioinformatics Programme.	Dr. Sreekumar, S.
2	A-113	Development of Tissue Culture Protocol for mass propagation of selected Screw pine ( <i>Pandanus</i> spp.) plants leading to technology transfer and establishment of tissue culture facility at KIDS.	Dr. K. Satheeshkumar
3	A-114	Systematic documentation of Traditional Knowledge Related to plants used for Food and Medicine from the Oral Tradition.	Dr. Vinodkumar T. G. Nair
4	A-168	Production and Supply of Quality Seedlings of selected 10 Medicinal Plants.	Dr. Mathew Dan
5	A-176	Identification of Potential Chemical Marker Compounds and Biological Studies of <i>Gloriosa superba</i> and their Geographical Variations.	Dr. S. R. Suja
6	A-193A2	Ecology and Conservation of Fresh water Swamp Ecosystems of the Western Ghats - Kerala Region.	Dr. M. Rajendra Prasad
7	A-193B1	Identification of the elite lines of <i>Centella asiatica</i> and <i>Bacopa monnieri</i> for commercially significant constituents for standardization of their extracts.	Dr. B. Sabulal
8	A-193B2	Bioprospecting of two coded anti-diabetic medicinal plants based on ethnomedical leads with special reference to diabetic complications. A molecular Pharmacological Approach.	Dr. S. R. Suja
9	A-193B4	Antiviral from medicinal plants of Western Ghats selected based on Traditional Knowledge/ Ethnomedical information.	Dr. S. R. Suja
10	A-203	Genetic Diversity Conservation and Population Study of Selected Notified Endangered Plant Species of Western Ghats	Dr. S. William Decruse

		Region of Kerala.	
11	A-219	Establishment of a Herbal Garden at Raj Bhavan.	Dr. Mathew Dan
12	A-222	Development of Lakeshore Leisure Trail Landscape, JNTBGRI, to enhance the aesthetics of the Garden.	Dr. R. Raj Vikraman
13	A-225	Cultivation, Conservation and Sustainable Utilization of Medicinal Plants Through the Participation of Unemployment Women Folks.	Dr. S. Binu
14	A-231	Training on Familiarization and Propagation of Medicinal Plants.	Dr. Mathew Dan
15	A-233	Effect of selected nanoparticles synthesized from plant secondary metabolite on seizures induced by kainic acid in mice.	Dr. V. Gayathri
16	A-241	DBT Fellowship.	Ms. Soumya S. Dharan
17	A-242	CSIR Fellowship.	Ms. S. Nusrin
18	A-248	CSIR studentship programme.	Ms. Divya S. Pillai
19	A-250	Exploration of Banana Biodiversity and its Biotechnological Research in Nagaland.	Dr. K. K. Sabu
20	A-255	Green Skill Development Programme (GSDP) - Entrusting the Certificate Course on Plant Tissue Culture Techniques and its Applications.	Dr. K. K. Sabu
21	A-257	Phytochemical profiling of the aromatic Cyperaceae members of South India.	Dr. K. B. Rameshkumar
22	A-258	Population Structure and Genetic Variability Analysis of <i>Cullenia exarillata</i> populations in Western Ghats.	Dr. K. K. Sabu
23	A-259	Analysis of genetic diversity, development of sex-linked SCAR markers and markers assisted selection of Aisan Palmyra palm ( <i>Borassus flabellifer</i> L., Arecaceae).	Dr. K. K. Sabu
24	A-260	Sustainable utilization of the seeds of <i>Garcinia</i> species from the Western Ghats.	Dr. M. Priya Rani
25	A-261	Biological Diversity awareness through setting up a butterfly garden in JNTBGRI (KSCSTE).	Dr. S. Anilkumar
26	A-266	ICMR Studentship programme of Reshmi Nair R. J.	Mrs. R. J. Reshmi Nair
27	A-268	ICMR Studentship programme of Vini C. Sekhar.	Mrs. Vini C. Sekhar

28	A-269	Taxonomic revision and phylogeny of the genus <i>Piper</i> L. (Piperaceae) in India with its Biogeography.	Dr. Mathew Dan
29	A-271	Conservation of Endemic and critically endangered <i>Buchanania barberi</i> in India.	Dr. Anurag Dhyani
30	A-272	KSCSTE Studentship programme of Mrs. Aswathy Anand.	Mrs. Aswathy Anand
31	A-274	Back to Lab Programme: Molecular phylogeny of Meliolaceous fungi of Kerala.	Mrs. S. S. Dhanusha
32	A-275	Digitization of Botanical Herbarium of Department of Botany, University of Kerala. funded by the University of Kerala.	Dr. Sreekumar, S. & Dr. C. K. Biju,
33	A-276	M. Sc. Integrated Biotechnology students.	Director, JNTBGRI
34	A-278	Population Biology of <i>Humboldtia unijuga</i> var. <i>trijuga</i> , an endemic and endangered tree species of the southern Western Ghats and its conservation.	Dr. P. S. Jothish
35	A-279	Travel grants to Mr. Nandu T. G., SRF for the tour conducted to Sri Lanka.	Mr. T. G. Nandu
36	A-280	Population Dynamics and agroecology of <i>Trichopus zeylanicus</i> Gaertn. subsp. <i>travancoricus</i> (Bedd.) Burkill ex Narayanan 'Árogyappacha'.	Dr. C. Anilkumar
37	A-281	DST INSPIRE Fellowship of Mrs. Aswathy, J.	Mrs. J. Aswathy
38	A-282	The production of 50000 seedlings of <i>Tinospora cordifolia</i> as a part of Nation-wide campaign on 'Amrita for Life'.	Dr. Mathew Dan
39	A-283	Conservation of Vulnerable Sandalwood ( <i>Santalum album</i> L.) through propagation and reintroduction, funded by Kerala Forest Development Fund (Rs. 18,39,200/-).	Dr. Anurag Dhayni
40	A-284	Landscaping and Gardening in the G. V. Raja Sports School campus, funded by Directorate of Sports and youth Affairs, Govt. of Kerala.	Dr. Sreekumar, S.
41	A-285	Certificate Course on Quality Planting Material Producer to KSCSTE-JNTBGRI, Palode.	Dr. Mathew Dan
42	A-286	Certificate Course on Plant Tissue Culture Techniques and its Applications to KSCSTE-JNTBGRI, Palode.	Dr. K. K. Sabu

43	A-287	Central Instrumentation Facility, Internship, training, workshop <i>etc.</i>	Dr. K. K. Sabu & Dr. K. B. Rameshkumar
44	A-288	Development of Controlled Release Formulation of Eco-friendly Pesticides in Stored Pest Management.	Dr. V. Gayathri
45	A-290	Establishment of Biodiversity Park at Block Panchayat Premises, Chirayinkeezhu, Thiruvananthapuram (Chirayinkeezhu Block Panchayat).	Dr. R. Raj Vikraman
46	A-292	Conservation of Orchids - Setting up of Orchidarium and Orchid Interpretation Centre at Eravikulam National Park (UNDP).	Dr. Mathew Dan
47	A-293	Search for Potential Biologically Active Constituents from the Indian Pitcher Plant, <i>Nepenthes khasiana</i> .	Dr. B. Sabulal
48	A-294	Three days training for selected unemployed women on familiarization and methods of cultivation of selected economically important medicinal plants.	Dr. S. William Decruse
49	A-295	One year student project programme	Dr. S. R. Suja
50	A-296	Eco-restoration and sustainable development of Poredam, Mahadevar Temple's sacred grove at Chadayamangalam, Kollam (KSBB).	Director, JNTBGRI
51	A-297	Best paper award project.	Dr. A. L. Aneesh Kumar
52	A-298	Establishment and upgradation of Bamboo Craft Centre at JNTBGRI, funded by Kerala State Bamboo Mission (Rs. 7,50,000/-).	Dr. Mathew Dan (Dr. B. Gopakumar)
53	A-299	Establishment of Bamboo Tissue Culture Unit and expansion of Bamboo Conservatory at JNTBGRI campus (Kerala State Bamboo Mission).	Dr. Mathew Dan
54	A-300	Establishment of Bio-park in Kukkirippara (Maranalloor Panchayat), Thiruvananthapuram District (KSBB).	Dr. R. Raj Vikraman
55	A-301	Preparation of Red Data Book and Assessment of Threatened Species of Kerala.	Dr. Nazarudeen Ahammed
56	A-302	Chemical Profiling of cardamom essential oils.	Dr. B. Sabulal
57	A-303	Eco Tourism at Jawaharlal Nehru Tropical Botanical Garden and research Institute,	Director, JNTBGRI

		Palode, Thiruvananthapuram.	
58	A-304	Beautification of Virology campus	Dr. R. Raj Vikraman
59	A-305	Pumba river biodiversity conservation.	Dr. E.S. Santhosh Kumar
60	A-306	The livelihood enhancement of the tribal of Njaraneely ward for Peringammala Panchayat, Thiruvananthapuram District, Kerala through plant enrichment buy back and herbal products development (DST, Govt of India).	Dr. S. Binu
61	A-307	<i>Ex-situ</i> conservation of five critically endangered plants of the Western Ghats, India.	Dr. Anurag Dhani
62	A-308	Habitat distribution modelling and re-inforcement of threatened trees in the Kerala region of the Western Ghats for the improvement of their conservation status. PI Dr. R. K. Radha, Funding agency MoEF & CC, Govt. of India.	Dr. R. K. Radha
63	A-309	Micro propagation and Cultivation of Native Orchids and Hybrids for On-Farm Conservation and income generation in Kerala through Cluster formation. (Rs. 1,83,07,280/-)	Director
64	A-310	Establishment of a biorepository of the plants in the Southern Western Ghats of India with particular emphasis on endemics (BGCI GGI Gardens Award Programme)	Director
65	A-311	Erudite public lecture	Director
66	A-312	CSIR Fellowship - Ms. Arya	Ms. C. P. Arya
67	A-313	Establishing a Butterfly Garden at Aashramam Biodiversity Centre, Kollam	Dr. S. Anilkumar
68	A-314	CSIR, Fellowship Mr. Muhammed Ali	Mr. Muhammed Ali
69	A-315	Reverse the Red: Assessing the population trends and developing recovery programme for two <i>Cinnamomum</i> species endemic to the Western Ghats.	Dr. Deepu Sivadas
70	A-316	Nutritional analysis and development of nutraceuticals/ food supplements based on Arogyapacha: an ethnomedically important plant.	Mrs. Angala Mathew
71	A-317	GSDP	Dr. R. Raj Vikraman

72	A-318	Development of propagation techniques and establishment of nurseries for indigenous RET plants and species notified under Biological Diversity Act and promoting cultivation with the support of research organizations, Kudumbasree and MNREGS.	Dr. A. Nazarudeen
73	A-319	National Seminar	Dr. K. B. Rameshkumar
74	A-320	INSA Fellowship	Dr. Anurag Dhyani
75	A- 321	Species distribution modelling and bioprospecting of wild germplasm of <i>Salacia</i> species (high value antidiabetic plants) across the Western Ghats. PI: Dr. R. K. Radha, financed by National Medicinal Plants Board, Ministry of Ayush, Govt. of India.	Dr. R. K. Radha
76	A-322	Inventory Systematics and conservation of <i>Ixora</i> L. (Rubiaceae) of Kerala (Kerala Forest Department).	Dr. G. Rajkumar & Dr. A. Nazarudeen
77	A-323	Tri party action plan for the reintroduction of Red Plants of Kerala.	Dr. C. Anilkumar
78	A-324	Open house	Dr. K. B. Rameshkumar
79	A-325	Establishment of Centre of Excellence in Phytochemical Nanotechnology, KSCSTE-SHRESTA Programme.	Director, JNTBGRI
80	A-326	National workshop	Dr. C. K. Pradeep
81	A-327	<i>Green Kerala Initiative</i> (KSCSTE)	Director, JNTBGRI
82	A-328	Course fee for M.Sc. Biotechnology students	Dr. K. K. Sabu
83	A-329	Course fee for M.Sc. Biotechnology students	Dr. K. K. Sabu
84	A-330	Establishment of a green ambiance at the Institute of Advanced Virology IAV campus, Thonnakkal (IAV, Govt. of Kerala).	Dr. Sreekumar, S.
85	A-331	Evaluation and Characterization of Antimicrobial Potential of Wild Edible Mushrooms of Kerala (KSCSTE - E & E Scheme).	Dr. C. K. Pradeep
86	A-332	New Phytologist Foundation to Support the Research and teaching.	Dr. Anuraj Dhyani
87	A-333	Cardamom for rainforest conservation. Funding agency: Kerala Forest Development Fund (KFDF), Forest Department, Govt of	Dr. K. K. Sabu

		Kerala.	
88	A-334	Identification, creation of database, propagation, conservation and value addition of wild and underutilized edible varieties of leafy vegetables, tubers, fruits, pulses, edible mushrooms <i>etc.</i>	Dr. A. Nazarudeen
89	A-335	Documentation, Database and Conservation of Edible Mushroom Recourse of Kerala (KSBB).	Dr. C. K. Pradeep
90	A-336	Database on anti-viral plants with emphasize on nutraceuticals: <i>In silico</i> validation of phytochemicals and formulation of a herbal product. funded by Kerala State Biodiversity Board, Govt. of Kerala.	Dr. Sreekumar, S. & Dr. C. K. Biju.
91	A-337	Conservation, eco restoration and popularization of three endemic and threatened tree species of Kerala (Kerala Forest Department).	Dr. A. K. Sreekala
92	A-338	Survey and documentation of Folk use of plants used by the Kani tribes of Kerala part of Agasthyamala Bioserve with emphasis on NWFP based livelihood aspects (Funding by Kerala Forest Department).	Dr. G. Rajkumar & Dr. A. Nazarudeen
93	A-339	Building a Biorepository of Western Ghats Medicinal and Aromatic Plants, Global Genome Initiative for Gardens (GGI-Gardens Award), funded by United States Botanic Gardens & Botanic Gardens Conservation International, Richmond, United Kingdom. (Rs. 1,82,410/-)	Dr. Mathew Dan
94	A-341	Enhancement of population structure and genetic variability of two mutually benefited endemic species: <i>Macaca silenus</i> (Lion-tailed Macaque) and <i>Cullenia exarillata</i> in the rain forest ecosystem of Kerala, Western Ghats, funded by Kerala Forest Development Fund. (Rs. 16,76,000/-)	Dr. Anurag Dhyani
95	A-343	Renovation and annual maintenance of the existing garden in the premises of Energy Management Centre. Funded by EMC, Govt. of Kerala.	Dr. Sreekumar, S.

96	A-344	Preparation of a Monograph on Selected Medicinal Plants used as Substitutes / Adulterants in Ayurveda with special reference to <i>Mesua ferrea</i> L: An Integrated Pharmacognostic, Phytochemical and Pharmacological Approach. National Medicinal Plant Board (NMPB), Ministry of AYUSH, Government of India.	Dr. Suja, S. R.
97	A-346	High-End workshop (KARYASHALA) on Hands-on Training on High-End Scientific Equipment- Application of the hyphenated mass spectrometric techniques GC-MS and LC-MS in plant science research DST, Anusandhan National Research Foundation (ANRF), Govt. of India.	Dr. K. B. Rameshkumar
98	A-349	Establishment of green ambiance and a conservatory of anti-viral plants at the Institute of Advanced Virology. Funded by IAV, Govt. of Kerala.	Dr. Sreekumar, S.
99	A-351	Biotechnological interventions for defensible conservation and restoration of <i>Dialium travancoricum</i> Bourd., a Critically Endangered Endemic Tree of the Southern Western Ghats. PI: Dr. R. K. Radha, financed by SPG - SERB, DST, Govt. of India.	Dr. R. K. Radha
100	A-353	Establishing a Biorepository for the Plants of the Andaman Islands, funded by Global Genome Initiative for Gardens (GGI-Gardens Award), funded by United States Botanic Gardens & Botanic Gardens Conservation International, Richmond, United Kingdom. (Rs. 3,74,136/-)	Dr. Anurag Dhyani
101	A-361	Implementation of Special Purpose Planting in the selected natural habitats of the VSSC Campus as part of the Environmental Conservation & Clearance Committee (VSSC, ISRO, Govt. of India).	Dr. R. K. Radha

102	A-357	DBT Skill Vigyan Programme in Life Science and Biotechnology, DBT, Govt of India.	Dr. K. B. Rameshkumar
103	A-360	Scale up production of quality planting material of RET, endemic and high demand Medicinal Plants (MPs) for custom farming at Chhattisgarh State Medicinal Plant Board. Financed by Chhattisgarh State Medicinal Plant Board.	Dr. R. K. Radha,
104	A-362	Identification of wild <i>Phyllanthus emblica</i> of the Western Ghats and establishment of a field gene bank in JNTBGRI' funded by Kerala Forest Department. (Rs.14,44,000/-)	Dr. P. S. Jothish.
105	A-363	Ecological impact and value addition assessment for sustainable management of invasive <i>Nymphaea</i> species in the wetlands of Kerala. KSBB, Govt. of Kerala.	Dr. K. B. Rameshkumar
106	A-366	Implementation of special purpose planting in the selected natural habitats of the VSSC campus as part of the Environmental Conservation & Clearance Committee (ECC). Funded by VSSC, Govt. of india.	Dr. R. K. Radha
107	A-358	Functional Exploration of Therapeutic Etiquettes of a Novel Group of Antibiofilm agents Against Infectious Human Pathogens: Molecular, Proteomic and Biophysical Approach al Exploration of Therapeutic Etiquettes of a Novel Group of Antibiofilm agents Against Infectious Human Pathogens: Molecular, Proteomic and Biophysical Approach (Kerala Biotechnology commission).	Dr. Vipin Moha Dan

## RESEARCH COUNCIL

SN	NAME & DESIGNATION	POSITION
1	Dr. Balakrishnan Pisupathy Former Chairman, NBA Vice Chancellor, Trans Disciplinary University, Bangalore	Chairman

2	Prof. Aravind M Lali Professor & Head Centre of Energy Bioscience Institute of Chemical Technology Nathalal Parekh Marg, Matunga, Mumbai-400019	Member
3	Dr. Mohammed Aslam Senior Advisor Department of Biotechnology Ministry of Science & Technology 6-8 <sup>th</sup> Floor, Block 2, CGO Complex, Lodhi Road New Delhi -110 003	Member
4	Dr. Madhmitha Biswas Director Ministry of Environment, Forest & Climate Change Indira Paryavaran Bhavan, Jorbagh Road, New Delhi - 110 003	Member
5	Prof. M. Sabu Department of Botany University of Calicut Malappuram District Calicut University P.O. Pin. 673 635, Kerala	Member
6	Dr. N. Anil Kumar Director M.S. Swaminathan Research Foundation Community Agro Biodiversity Centre Puthoorvayal P.O. Meppadi, Wayanad Pin- 673 577, Kerala	Member
7	Dr. S. Pradeep Kumar Member Secretary Kerala State Council for Science Technology and Environment, Government of Kerala Sasthra Bhavan, Pattom P.O., Thiruvananthapuram-695 004	Permanent Invitee
8	Director Jawaharlal Nehru Tropical Botanic Garden & Research Institute, Palode, Thiruvananthapuram - 695 562	Member Convener

### MANAGEMENT COMMITTEE

SN	NAME & DESIGNATION	POSITION
1	Director, JNTBGRI	Chairman

2	Dr. S. Pradeep Kumar, Member Secretary, KSCSTE	Member
3	Dr. Syam Viswanath, Director, KFRI	Member
4	Dr. C. Anilkumar, Principal Scientist, JNTBGRI	Member
5	Mr. Madhu, Additional Secretary, Science & Technology Department	Member
6	Registrar, JNTBGRI	Member Convener

### STAFF LIST

SN	NAME	DESIGNATION
1	Dr. B. Sabulal (HoD, Phytochemistry)	Director (i/c, 31-07-2022 to 30-08-2023)
<b>Garden Management, Education, Information &amp; training Division</b>		
2	Dr. R. Raj Vikraman	Principal Scientist & Head
3	Dr. A. A. Prasannakumari	Scientist
4	Mr. V. Premkumar	Public Relations Officer
5	Dr. Raju Antony	Technical Officer Gr. III
6	Dr. Joemon Jacob	Technical Officer Gr. IV
7	Mr. S. Muhammed Shareef	Technical Officer Gr. IV
8	Dr. E. S. Santhosh Kumar	Technical Officer Gr. III
9	Dr. T. Sabu	Technical Officer Gr. III
10	Dr. K. J. Lathan Kumar	Technical Officer Gr. III
11	Dr. A. Hussain	Technical Officer Gr. III
12	Mr. K. S. Kalesh	Technical Officer Gr. II
13	Mr. B. Harilalkumar	Gardener Gr. IV
14	Mr. K. Vijayakumar	Gardener Gr. IV
15	Mr. K. Anilkumar	Gardener Gr. IV
16	Mr. J. Rajan	Gardener Gr. IV
17	Mr. V. Satheesan	Gardener Gr. III
18	Mr. M. Shajahan	Gardener Gr. IV
19	Mr. R. Lalan	Gardener Gr. I

20	Mr. R. Suresh Kumar	Gardener Gr. III
21	Mr. P. Babu	Gardener Gr. III
22	Mr. D. Udaya Kumar	Gardener Gr. III
23	Mr. N. Pradeep	Gardener Gr. III
24	Mr. P. S. Hanikumar	Label Writer
25	Mr. A. Ullas	Gardener Gr. I
26	Mr. S. Shafeerkhan	Photocopy Operator Gr. I
<b>Plant Genetic Resources Division</b>		
27	Dr. Mathew Dan	Principal Scientist & Head
29	Dr. M. Abdul Jabbar	Technical Officer Gr. III
30	Dr. M. Saleem	Technical Officer Gr. III
31	Dr. B. Gopakumar	Technical Officer Gr. IV
32	Dr. B. J. Radhika	Technical Officer Gr. IV
33	Mr. M. K. Sreekumaran	Technical Officer Gr. II
34	Mr. B. Jayakumar	Garden Maestri Gr. II
35	Mr. G. Manoharan	Gardener Gr. IV
36	Mr. S. Ajayakumar	Gardener Gr. IV
37	Mr. K. Ashok Kumar	Gardener Gr. IV
38	Mr. B. Jayalalkumar	Gardener Gr. IV
39	Mr. S. Thulaseedharan	Gardener Gr. IV
40	Mr. K. Asokachandran Nair	Gardener Gr. IV
41	Mr. G. Sudarsana Kurup	Gardener Gr. III
42	Mr. A. K. Azeem	Gardener Gr. III
43	Mrs. T. Mini Thomas	Gardener Gr. I
<b>Biotechnology and Bioinformatics Division</b>		
44	Dr. S. William Decruse	Principal Scientist & Head
45	Dr. S. Sreekumar	Principal Scientist
46	Dr. K. K. Sabu	Principal Scientist
47	Dr. C.K. Biju	Principal Scientist
48	Dr. R. K. Radha	Senior Scientist
49	Dr. M. Raveendran	Scientist
50	Dr. S. Shailaja Kumary	Technical Officer Gr. II

51	Mrs. V. S. Sindhu	Lab Attendant Gr. IV
52	Mrs. S. Syamala Kumary	Lab Attendant Gr. IV
53	Mrs. S. Kanakasundaram	Lab Attendant Gr. IV
54	Mr. B. Chandran	Gardener Gr. III
55	Mr. M. Vijayan	Gardener Gr. III
56	Mr. R. Anil Kumar	Gardener Gr. III
57	Mr. M. Shajahan	Gardener Gr. III
58	Mr. G.S. Madhusoodhanan Asary	Office Attendant Gr. III
59	Mrs. R. Sreekumari	Gardener Gr. I
<b>Conservation Biology Division</b>		
60	Dr. C. Anilkumar	Principal Scientist & Head
61	Dr. A. K. Sreekala	Principal Scientist
62	Dr. P.S. Jothish	Principal Scientist (upto 27-11-2023)
63	Mrs. A. Rasiyabeegam	Senior Scientist
64	Dr. Anurag Dhyani	Scientist
65	Mrs. C. R. Chitra	Technical Officer Gr. V
66	Mr. M. Sibi	Technical Officer Gr. V
67	Mr. S. Suresh	Technical Officer Gr. IV
68	Mrs. S. Bindu	Technical Officer Gr. IV
69	Mr. G. Madhu	Gardener Gr. I
<b>Ethnomedicine &amp; Ethnopharmacology Division</b>		
70	Dr. S. R. Suja	Principal Scientist & Head
71	Dr. Vinod Kumar T. G. Nair	Senior Scientist
72	Dr. M. Navas	T. O. Gr. IV (Deputation to SMPB)
73	Mr. S. Radhakrishna Pillai	Technical Assistant
74	Mr. G. Anilkumar	Lab Attendant Gr. IV
<b>Phytochemistry &amp; Pharmacology Division</b>		
75	Dr. B. Sabulal	Senior Principal Scientist & Head
76	Dr. K. B. Rameshkumar	Principal Scientist
77	Dr. V. Gayathri	Senior Scientist
78	Dr. Anil John J.	Technical Officer Gr. IV
79	Dr.S. Ajikumaran Nair	Technical Officer Gr. IV

80	Dr. S. R. Rajani Kurup	Technical Officer Gr. IV
81	Mrs. Sumitha B.	Technical Officer Gr. IV
82	Mr. G. Santhoshkumar	Technical Assistant
83	Mrs. P. Sasikala	Lab Attendant Gr. IV
84	Mrs. A. Leela	Office Attendant Gr. III
<b>Plant Systematics &amp; Evolutionary Science Division</b>		
85	Dr. G. Rajkumar	Principal Scientist & Head
86	Dr. M. Rajendraprasad	Principal Scientist
87	Dr. A. Nazarudeen	Senior Scientist
88	Dr. T. Shaju	Senior Scientist
89	Dr. V. S. Usha	Herbarium Asst. Gr. III
90	Dr. M. P. Geethakumary	Technical Officer Gr. IV
91	Dr. K. P. Deepthi Kumary	Technical Officer Gr. III
92	Dr. G. Thulasidas	Technical Officer Gr. III
93	Mr. R. Thulaseedharan Nair	Gardener Gr. III
<b>Microbiology Division</b>		
94	Dr. C. K. Pradeep	Principal Scientist
95	Dr. Vipin Mohan Dan	Scientist
96	Dr. H. Biju	Technical Officer Gr. III
97	Dr. A. Sabeena	Technical Officer Gr. III
98	Mrs. S. Sheeja	Office Attendant Gr. I
<b>CARC Programme</b>		
99	Dr. S. Binu	Principal Scientist
<b>Library and Information Centre</b>		
100	Mrs. V. Leena Kumary	Office Attendant Gr. II
101	Mr. C. R. Vinu Krishnan	Office Attendant Gr. II
<b>Administrative Staff</b>		
102	Mr. M. Anilkumar	Sect. Officer Gr. I
103	Mrs. R. Subha Sankar	Computer Operator Grade III
104	Mrs. R. Sofia	Assistant Grade II
105	Mrs. S. Sudha	Assistant Grade I
106	Mr. Vishnu P. S.	Assistant Grade I

107	Mr. K. P. Eliyas	Store Assistant Gr. II
108	Mr. K. Mohammed Habeebulla	Typist/ Data Entry Operator Gr. III
109	Mr. B. R. Dinesh	Record Keeper Gr. II
110	Mr. G. Murukesan Nair	Driver Gr. I
111	Mr. S. Sanalkumar	Driver Gr. I
112	Mr. N. Hariprasad	Driver Gr. I
113	Mr. Balachandran	Driver Gr. I
114	Mrs. K. S. Bindu	Office Attendant Gr. II
115	Mrs. J. Anithakumari	Office Attendant Gr. I
<b>Engineering Section</b>		
116	Mr. S. Ajith	Assistant Work Supervisor Gr. IV
117	Mr. V. S. Sureshkumar	Technical Assistant Gr. IV
118	Mr. P. Ajithkumar	Technical Assi. (Electrical) Gr. IV
119	Mrs. M. R. Geetha	Technical Assistant
120	Mr. G. Ajayakumar	PABX Operator Gr. II
121	Mrs. K. Lalikutty	Sweeper Gr. III
<b>Security Section</b>		
122	Mr. S. Vikraman Nair	Security Guard Gr. I
123	Mr. R. Prasannakumar	Security Guard Gr. I
124	Mr. R. Nagappan	Security Guard Gr. I
125	Mr. G. Anilkumar	Security Guard Gr. I

## **EXPENDITURE STATEMENT**

**Jawaharal Nehru Tropical Botanic Garden & Research Institute**  
 Palode, Thiruvananthapuram  
 (A Unit of Kerala Council For Science, Technology and Environment of Govt of Kerala)  
**Income and Expenditure Account for the year ended 31st March, 2024**

In (₹.)

Expenditure	Sch no.	Year Ended 31 March 2024	Year Ended 31 March 2023	Income	Sch no.	Year Ended 31 March 2024	Year Ended 31 March 2023
To Research & Development Expenses(Plan)	9	4,91,26,511	4,50,17,668	By Grant From Govt of Kerala Reckoned	13	20,66,85,826	19,85,95,210
To Salaries and Allowances (Non Plan)	10	16,34,34,127	16,48,47,966	By Other Receipts	14	55,47,482	1,20,91,493
To Administrative Expenses (Non Plan)	11	43,432	8,21,070	By Interest from Banks		3,70,762	-
To Expenditure to External Projects	12	1,70,48,087	1,72,53,127	By External Projects	15	1,60,17,279	1,63,19,907
To Depreciation	5A	1,01,62,398	89,34,249	Grant for External Projects Reckoned	16	5,31,648	9,33,220
Institute				Other Receipts-External Projects		4,99,160	-
External Projects	5B	75,90,289	86,13,050	Interest from Bank		1,77,52,687	1,75,47,299
<b>TOTAL</b>		<b>24,74,04,844</b>	<b>24,54,87,130</b>	By Depreciation written back			
				<b>TOTAL</b>		<b>24,74,04,844</b>	<b>24,54,87,130</b>

The accompanying notes form an integral part of the financial statements  
 For Jawaharal Nehru Tropical Botanic Garden & Research Institute

In terms of our report attached.

For JAKS & Associates  
 Chartered Accountants  
 FRN:0013605

Director

Finance Officer

Registrar

SELASTIN A. F. C.A.  
 Partner

Membership No - 202874

UDIN:2420287406KZMC816

**DIRECTOR**  
 Jawaharal Nehru Tropical Botanic Garden & Research Institute  
 Palode, Thiruvananthapuram, Kerala 695562



Finance Officer  
 Jawaharal Nehru Tropical Botanic Garden & Research Institute  
 Palode, Thiruvananthapuram - 695 562



JAKS & ASSOCIATES  
 CHARTERED ACCOUNTANTS  
 PALODE, THIRUVANANTHAPURAM

# BALANCE SHEET

Palode, Thuvuvanthapuram  
 (A Unit of Kerala State Council for Science, Technology and Environment of Govt. of Kerala)  
**Balance sheet as at 31st March 2024**

Liabilities	Sch No.	As at 31 March 2024	As at 31 March 2023	Assets	Sch No.	As at 31 March 2024	As at 31 March 2023
<b>Capital Reserve</b>				<b>Property, Plant &amp; Equipment</b>			
Institute	1A	7,44,89,251	6,99,13,636	Institute	5A	7,44,89,250	6,99,13,636
External Projects	1B	5,35,85,416	5,93,05,082	External Projects	5B	5,30,85,416	5,93,05,082
<b>Unspent Balance</b>				<b>Current Assets</b>			
Institute	2A	21,74,384	(5,73,30,637)	Institute	6A	2,09,91,957	3,83,31,972
External Projects	2B	2,56,69,027	2,01,04,814	External Projects	6B	2,89,08,247	2,14,38,467
General Fund	2C	51,89,468	2,40,93,729				
Book Publication Reserve			4,79,03,075	<b>Loans &amp; Advances</b>			
Orchid Farming Project Reserve			2,09,904	Institute	7A	1,59,71,541	1,56,32,543
			3,00,000	External Projects	7B	5,42,341	2,47,374
<b>Loan Funds</b>				<b>Suspense Accounts</b>			
	3	-	4,23,291		8	4,84,466	9,07,756
<b>Current Liabilities</b>				<b>Total</b>		<b>19,44,73,218</b>	<b>20,57,76,830</b>
Institute	4A	2,53,13,855	3,38,99,229				
External Projects	4B	26,76,136	10,81,027				
<b>Control Accounts</b>							
Suspense Accounts External Projects		25,73,594	25,73,594				
STFC / CSIR / UGC		23,63,850	23,63,850				
		4,36,237	4,36,237				
<b>Total</b>		<b>19,44,73,218</b>	<b>20,57,76,830</b>	<b>Total</b>		<b>19,44,73,218</b>	<b>20,57,76,830</b>

The accompanying notes form an integral part of the financial statements  
 For Jawaharlal Nehru Tropical Botanic Garden & Research Institute

In terms of our report attached.

For JAKS & Associates  
 Chartered Accountants  
 FRN/0013605

  
**Director**  
 Jawaharlal Nehru Tropical Botanic Garden & Research Institute  
 Palode, Thuvuvanthapuram, Kerala 695562

  
**S. SYAM KUMAR**  
 Registrar  
 Jawaharlal Nehru Tropical Botanic Garden and Research Institute  
 Palode, Thuvuvanthapuram, Kerala 695562

  
**SELASTINA A. F.C.A**  
 Partner  
 Membership No. - 202874  
 UDIN: 242024149KZMC866T

