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ICFRE - Institute of Forest Genetics and Tree Breeding (ICFRE - IFGTB), Coimbatore is a National Research Institute under the Indian Council of Forestry Research and Education. ICFRE - IFGTB envisions a wood secure society. The Institute primarily aims to carry out research to improve productivity of forest tree species through conventional breeding programmes and biotechnological interventions. The major areas of research include tree improvement, breeding, planting stock improvement, marker assisted selection, genomics, clonal propagation, agroforestry systems, climate change research, integrated disease and pest management, seed handling and testing, eco restoration and conservation.

ABOUT EIACP

EIACP (erstwhile ENVIS) established by the Government of India, in 1982 has been providing environmental information to decision makers, policy planners, scientists and engineers, research workers, etc. all over the country. It is a comprehensive decentralized information system on environment involving effective participation of institutions / organisations in the country actively engaged in work relating to different subject areas of environment. A large number of nodes, known as EIACP PC RP (erstwhile ENVIS Centres), have been established in the network to cover the broad subject areas of environment with a Focal Point in the Ministry of Environment, Forest and Climate Change.

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Details may be sent to: ifgtb@envis.nic.in.

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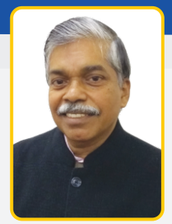

In this issue

From the
Director's Desk

Forest Genetic Resources (FGR) encompass woody perennials with both present and future economic, social, or conservation values. This newsletter edition primarily emphasizes the significance of a woody medicinal plant, *Oroxylum indicum*, a key ingredient in Dasamula, with its roots serving as the primary source of active principles. However, due to over-collection of roots and bark, this species faces a threat, necessitating urgent conservation efforts. Additionally, this edition details regular activities and commemorations of significant events such as Van Mahotsav, World Mangrove Day, World Ozone Day, and more. It is anticipated that this newsletter will prove invaluable to our stakeholders, offering insights and updates relevant to their interests and pursuits.

Dr C. Kunhikannan
Director, ICFRE - IFGTB

Know your trees - *Oroxylum indicum* (L.) Kurz.

Introduction

Oroxylum indicum (L.) Kurz commonly known as Indian trumpet flower or Indian caper belong to Begoniaceae family is a remarkable botanical species native to the Indian subcontinent, south east Asian country. Renowned for its ornamental beauty and diverse medicinal properties, this plant has captured the interest of botanists, herbalists, and traditional medicine practitioners. With its striking appearance and cultural significance, *O. indicum* stands as a symbol of the rich botanical heritage of the region. Through its unique characteristics and traditional uses, it offers a fascinating glimpse into the intersection of nature and human culture.

Vernacular names

Shayonak Kul (Ayurvedic); Hanyu pinyin, Mu hudie, Butterfly tree (Chinese); Broken bones plant, Indian calosanthes, Indian trumpet, Indian trumpet flower, Mid night horror, Tree of Damocles (English); Bonglai (Malaysia); Tentu (Gujrati); Patrorna, Putiveriksha, Shallaka, Shuran, Son, Vatuk, Arlu, Urru, Sauna (Hindi); Anemungu (Karnatka); Devamadak(Konkani); Tatelo (Nepalese); Palakappayyani, Vella, Pathiri (Malaylam); Aralu, Shyonaka (Sanskrit); Totila, Thotila (Singhala-Sri-Lanka); Cari-konnai, Kalai-y-utaicci, Puta-puspam, Achi, Pana, Pei-maram, Venga maram, Peruvaagai (Tamil); Manduka-paramu, Pampena, Suka-nasamu, Dundilamu, Pampini, Nemali, Chettu (Telugu); Other common names Kampong, Sonapatta, Sonaapaathaa, Urru, Saona, Tatpalenga, Kinnauri phool, Shoshana, Tuntuka, Kutunata, Mandukparna, Bhalluka, Prthushimba, Katvan.

Distribution and habitat

It hails from the Indian subcontinent, primarily dwelling in the Himalayan foothills with extensions into Bhutan and southern China, as well as Indo-China and the Malaysia eco-zone. Notably, it graces the forest biome of Manas National Park in Assam, India, and has been sighted in Sri Lanka (Ceylon) according to Theobald (1981). Its habitat spans across Fujian, Guangdong, Guangxi, Guizhou, Sichuan, Taiwan, Yunnan, Cambodia, India, Indonesia (Java, Sumatra), Laos, Malaysia, Myanmar, Nepal, Philippines, Thailand, and Vietnam, as noted by Lawania *et al.* (2010). Within China, India, Nepal, Bhutan, Myanmar, Thailand, and beyond, it thrives in diverse regions. Its preferred habitats include ravines, damp regions, and moist forest areas, typically found at altitudes up to 1200 meters. In India, it enjoys a distribution that spans the Himalayan foothills, Eastern and Western Ghats, and the North East region.

Botanical description

Medium-sized trees reach height up to 12 meters, with bark measuring 5-6 mm thick, presenting a brownish-grey surface and a yellowish-green blaze. The bole is smooth in texture. Leaves are compound, typically 2-3 pinnate, with each pinna bearing 5-9 leaflets. The imparipinnate leaves are arranged oppositely on a stout, glabrous rachis measuring 60-100 cm. Each leaflet is opposite, with a slender, glabrous petiolule ranging from 3-20 mm in length. The ovate lamina measures 7.5-15 x 4-9 cm, featuring a cordate, oblique, or truncate base and an acuminate apex. The margin is entire, and the leaves are glabrous and chartaceous. Lateral nerves are 4-6 pairs, prominent, and puberulent beneath, while intercostae are reticulate. The bisexual flowers form lax terminal racemes, with reddish-purple exteriors and pinkish-yellow interiors, extending up to 30-50 cm long. Pedicels are 1-2 cm long, and the calyx is campanulate, measuring 2.5 cm in length, with a truncate or obscurely toothed limb. The corolla is large, fleshy, and campanulate, with lobes reaching 3 cm in length. Five stamens, perfect, are present, with the posterior one being the shortest. Filaments are inserted below the base of the tube and hairy at the base, while the connective bears a short mucrone. The subsessile ovary is contracted at the base, containing numerous ovules. The style is slender, and the stigma is 2-lobed. The fruit is a capsule measuring 40-75 x 5-8 cm, with two valves and a compressed shape tapering at both ends. Seeds are winged all around, except at the base, measuring 5-6 cm in length.

Reproductive biology and breeding system

O. indicum displays a unique flowering pattern characterized by steady-state flowering, with one or two flowers per inflorescence opening each night. These flowers typically bloom in the evening and drop off shortly after midnight. Notably, its bilabiate stigma exhibits high sensitivity, promptly closing upon contact. Research has confirmed *Oroxylum indicum*'s self-incompatibility, with hand-cross pollination and open pollination resulting in the highest pollination success rates (47.7% and 31.2%, respectively, n = 7 trees) (Sukanya and Sridhar, 2016). Approximately 900 pollen grains are

required to initiate fruit set in this species. Given its self-incompatible breeding system, *O. indicum* relies heavily on pollinators for successful reproduction. Fruit bats, particularly *Eonycteris spelaea*, have been identified as the primary pollinators, responsible for depositing all pollen loads. However, despite their effectiveness, fruit bats are considered inefficient pollinators, with only the first visit significantly contributing to female reproductive success. On average, the stigma receives sufficient pollen grains during the initial visit of *E. spelaea*. However, approximately 40% of stigmas receive less than the minimum required pollen count for fruit setting (Sridhar and Soumya, 2014). This dependence on a single pollinator species, coupled with the inefficiency of *E. spelaea*, raises concerns about the potential impact of declining bat populations on *O. indicum*'s reproductive success. The highly self-incompatible nature of *O. indicum* underscores the vital role of cross-pollination for successful reproduction, with selfing being a rare occurrence. This breeding system aligns with predictions based on the species' pollen-to-ovule ratio (Cruden, 2000).

Fruit collection and processing

O. indicum produces 130-226 flower buds arranged on 1-2m flagelliflorous inflorescences.

One tree produces 1 – 40 simultaneously flowering inflorescences. The flowers bloom only in the night. One to four flowers per inflorescence open at a time. The flowers are pollinated by bats. The seed pods are extremely conspicuous, reaching up to four feet in length and about three inches in width. They curve downwards hanging down from the branches. The pods dehisce septicidally, and the inner septum is woody. White seeds are arranged in several rows, 100-150 in number, very thin, compressed, rounded, surrounded by a transparent broad wing. When the pods dehisce at maturity, these seeds flutter to the ground, often traveling some distance. Natural regeneration is very profuse. However, the establishment of the seedlings is very poor. Being very thin and papery in nature, collection of seeds from the ground becomes very difficult once dehiscence is complete. Mature pods are collected from the tree and seeds are extracted following manual cracking of the pods. The average 100 seed weight is 0.60 g. One pod can yield 100-150 seeds. (Warrier *et al.,* 2020).

Germination

Fresh seeds of *O. indicum* possess low moisture content, measured at 5.73%, indicative of their tolerance to low temperatures and adherence to orthodox storage behavior. However, seed viability shows a significant decline over time. At the point of collection, 83.33% of seeds were viable, but after 3 months of storage at room temperature, viability decreased to 62.5% ($p < 0.05$), further plummeting to 41.67% after 6 months (Mithilesh Singh *et. al.,* 2017). To explore storage conditions, seeds were stored in sealed polybags at various temperatures: ambient (25-28°C), 20°C, 5°C, and -15°C for 18 months. It was found that seeds could be stored at 20°C for 18 months with a viability retention of 75%, with an initial germination rate of 37%. Germination, which is hypogeal in nature, typically commences within 5 days of sowing. Pre-soaking seeds in cold water for 6 or 12 hours enhances germination rates and promotes better seedling growth (Warrier *et al.,* 2020). Among the growth media examined, 100% leaf mold exhibited the most favorable conditions for seedling development. Additionally, different fertilizers, including Neem-coated urea, Potassium Nitrate, Calcium Nitrate, and Ammonium Sulphate, were studied on seedlings, with the highest growth (21.42% increase in height) observed under certain conditions (Kumar *et al.,* 2017).

Vegetative propagation

For vegetative propagation of *O. indicum*, hardwood and limb cuttings measuring 30 cm in length, each with 4-5 buds, are found to be suitable. These cuttings, treated with a solution containing 200 ppm of NAA (Naphthaleneacetic acid) + 3000 ppm of IBA (Indole-3-butyric acid), are soaked for 5 minutes before being planted in a suitable planting media. The cuttings are then placed in a polyhouse under partial shade conditions, with approximately 50% shade, while maintaining an average temperature of 20°C. Observations made at intervals of 30 days revealed encouraging results: a high percentage of cuttings exhibit sprouting (86.67%), with an average of 7.05 shoots per cutting and a shoot length of 10.97 cm. Additionally, the number of leaves per cutting averages at 28.33. Rooting percentage is reported at 60.33%, with each rooted cutting producing an average of 43.30 roots, with an average root length of 31.53 cm (Pandey *et al.,* 2017).

***In vitro* propagation**

Initially, the seeds were soaked overnight in water, followed by the removal of their papery wings. Subsequently, the wing-free seeds are processed by surface sterilization using 1% mercuric chloride, followed by thorough washing in sterile distilled water three times. Once sterilized, the seeds were dried and inoculated in a medium containing 1% water agar. Remarkably, the seeds exhibited robust germination under in-vitro conditions. Upon transplantation and hardening in a mixture of soil, sand, and farmyard manure (in a ratio of 1:2:1), an exceptionally high survival rate of 90–92% was observed among the resulting plantlets (Singh *et al.,* 2013).

Insect pests and diseases

There are no reported cases of diseases or nematode attacks affecting *O. indicum*. However, during the rainy season, leaf-eating caterpillars such as the Bihar hairy caterpillar (*Diacrisia obliqua*) and grasshoppers are known to cause damage to the leaves. Additionally, termite infestations pose a significant threat, particularly to the root bark of plants grown in drier lands. To mitigate these issues, the application of Endosulphan 30 EC spray at a concentration of 0.03% in water solution is recommended. This spray should be administered twice, with a 15-day interval between applications, as soon as termite activity is detected (Rajput *et al.,* 2018).

Planting techniques and post planting operation

To prepare for field cultivation, it is advisable to establish a nursery for *O. indicum* plants in polythene bags during the latter half of March. These bags should be filled with sandy-loam soil enriched with high-quality, well-decomposed farmyard manure (FYM) in a ratio of 2:1. Once the seedlings emerge, consistent watering is essential to maintain an optimal moisture level. Typically, 250 grams of seeds are adequate to raise enough stock for plantation on a one-hectare plot of land. (Chandra *et al.,* 2015).

Land preparation and fertilizer application

To prepare the land for cultivation, it is essential to till the soil thoroughly to achieve a porous, friable texture while ensuring it is free from weeds. Pits of suitable dimensions, ideally measuring 60 × 60 × 60 cm, are then excavated in a square planting pattern, with each pit spaced at intervals of 2 × 2 m. In the topsoil of each pit, a mixture comprising approximately 10 kg of farmyard manure (FYM), 150 grams of nitrogen, and 250 grams of single superphosphate is evenly incorporated. Subsequently, the pit is loosely refilled before planting the *O. indicum* saplings (Biswas *et al.,* 2014).

Transplanting and optimum spacing

Transplantation into the primary field typically occurs during the initial week of July, coinciding with the onset of the monsoon season in central India. Recommended spacing of 2 × 2 m is deemed suitable for this process. With this spacing, an optimal crop stand of 2500 plants

per hectare is attained. Any gaps in the plantation are filled in September, ensuring uniform coverage and plant distribution (Kumar *et al.,* 2016).

Interculture and maintenance practices

To ensure optimal growth and yield of *O. indicum*, a well-balanced nutrient management strategy is essential. Approximately 20 kg of well-decomposed farmyard manure (FYM), along with 150 g of nitrogen and 250 g of superphosphate per plant, should be applied in three split doses at intervals of six months over the first two years following transplanting (Sahu *et al.,* 2019). Additionally, the application of potash is recommended, especially in soils deficient in potassium. Regarding weed management, two rounds of wedding along with hoeing are typically considered sufficient. However, for effective control, more frequent manual weeding around the pit area may be necessary as required (Sridhar and Nair, 2015).

Irrigation practices

For optimal growth and productivity of *O. indicum*, proper irrigation management is crucial, particularly during the initial stages of growth. In the first year, it is recommended to irrigate the plants at least six to eight times, with additional irrigation sessions during the summer months to mitigate water stress and promote vigorous growth. Ideally, irrigation intervals of 7 to 10 days are desirable during the hotter months to maintain soil moisture levels (Gupta *et al.,* 2019). The check basin method is considered the most effective technique for irrigation in *O. indicum* cultivation, as it allows for efficient water distribution and minimizes water wastage (Chandra *et al.,* 2018).

Harvest management

Crop maturity and harvesting

The tree begins flowering and fruiting after three years of growth, with viable seeds often developing during the initial fruiting period. The fruits take approximately three to five months to reach maturity, signaling readiness for harvesting. However, for the extraction of root bark, a crucial medicinal component, the plants are typically uprooted only after six to eight years, with the harvesting period spanning from October to December (Bhatt *et al.,* 2017). This timeline ensures optimal yield and quality of the root bark while allowing the tree sufficient time to establish robust root systems and accumulate essential phytochemical constituents.

Post-harvest management

Harvesting and processing of *O. indicum* root bark involve several meticulous steps to ensure quality and efficacy. Initially, a pit is dug around the base of the tree and filled with water to facilitate the uprooting process. Once uprooted, the roots are meticulously cleaned to remove any soil or debris. Subsequently, the bark is carefully peeled off, and the roots are cut into smaller pieces. These pieces are then subjected to shade-drying to reduce their moisture content to less than 12%. Finally, the dried material is carefully stored in moisture-proof bags to maintain its quality and potency (Bhatt *et al.,* 2017). This methodical approach not only preserves the medicinal properties of the root bark but also ensures its long-term storage viability.

Agroforestry practices

Cultivation of *O. indicum* offers versatile options, suitable for both solitary cultivation and integration into mixed cropping systems. In mixed cropping, the utilization of inter-spaces between *O. indicum* plants after the first year of growth presents an opportunity to grow short-term seasonal herbs, augmenting land productivity and providing supplementary income avenues for farmers (Dhawan *et al.,* 2019). Furthermore, integrating nitrogen-fixing leguminous plants into these cropping systems, as suggested by Joshi *et al.* (2018), can contribute to soil fertility enhancement and overall ecosystem vitality. Notably, practices such as intercropping facilitate sustainable agricultural methods while diversifying crop production. Specifically, incorporating coriander (*Coriandrum sativum*), fenugreek (*Trigonella foenum-graecum*), and mint (*Mentha* spp.) as intercrops alongside O. indicum can effectively utilize available space and resources, maximizing agricultural outputs (Dhawan *et al.,* 2019). Moreover, the inclusion of leguminous crops like pigeon pea (*Cajanus cajan*) and green gram (*Vigna radiata*) complements this strategy by contributing to soil nitrogen fixation, thus promoting soil health and agricultural sustainability (Joshi *et al.,* 2018). This integrated approach not only optimizes land utilization but also underscores the importance of ecological balance and diversified agricultural practices in fostering resilient farming systems.

Tree improvement

The Seed Production System (SPS) is a crucial technology aimed at ensuring a continuous and reliable supply of quality seeds. This system can be implemented using either natural or artificial stands, with the latter being particularly advantageous as it introduces maximum genetic diversity (Warrier *et al.,* 2020). By preserving, regenerating, and maintaining the productivity

Know your trees - *Oroxylum indicum* (L.) Kurz.

and diversity of resources, the SPS plays a vital role in sustainable agriculture (Saxena & Kumar, 2017). Specific design considerations are essential to maximize the benefits derived from the SPS.

The distribution of *O. indicum* has been identified as regionally vulnerable due to habitat loss and harvesting for medicinal purposes, underscoring the need for large-scale cultivation (Sharma & Kumar, 2015). Despite its potential, *O. indicum* has rarely been cultivated outside its natural range and lacks a history of repeated introductions. To address this gap, a Seed Production System has been established, utilizing accessions from different regions of Tamil Nadu and Kerala. After a decade, the trees in this germplasm assemblage have reached a height of 6 meters and have commenced flowering, marking the success of the initiative(Warrier *et al.,* 2020). This seed stand will serve as a vital resource, ensuring a continued supply of seeds for future cultivation efforts (Reddy *et al.,* 2019).

Utilization

O. indicum holds a prominent place in Ayurvedic medicine, featuring as a key ingredient in several widely-used formulations. It serves as a crucial component in various Ayurvedic preparations,

including Dasamularistha, Syonaka putapaka, Syonaka sidda ghrta, Brhatpancamulyadi kvatha, Amartarista, Dantyadyarista, Narayana Taila, Dhanawantara Ghrita, Dhanawantara Tailam, Brahma Rasayana, and Chyavanaprasa (Gupta *et al.,* 2018). The utilization of *O. indicum* in these formulations underscores its therapeutic significance and highlights its versatility in addressing a wide range of health concerns according to Ayurvedic principles.

Chemical constituents

O. indicum is renowned for its diverse array of phytochemicals, distributed across different parts of the plant. The root bark, rich in medicinal compounds, contains notable constituents such as chrysin, baicalein, dehydrobaicalein, and oroxylin (Gupta *et al.,* 2018). Meanwhile, the stem bark harbors flavonoids including oroxylin, baicalein, scutelarin, and 7-rutinoside, alongside chrysin and p-coumaric acid (Patel *et al.,* 2015). Additionally, the heartwood of O. indicum yields β-sitosterol and isoflavone-prunetin, further contributing to its pharmacological profile (Rao *et al.,* 2014). These diverse bioactive compounds confer various medicinal properties to different parts of the plant, making it a valuable resource in traditional and modern medicine.

Yield and cost of cultivation

A six-year-old tree typically yields only 1 kg of dried root bark, translating to an estimated yield of about 4.0 quintals per hectare per year from the sixth year onwards (Yadav *et al.,* 2017). However, this modest yield is counterbalanced by the lucrative market value of the species. Twigs of *O. indicum* are traded in India at Rs. 9 per kg, while its extracts command a significantly higher price of Rs. 500,000 per kg on the international market (Choudhary and Yadav, 2014). This stark difference in market value underscores the economic potential of cultivating *O. indicum*.

Moreover, market trends indicate a steady demand for *O. indicum* products. From 2006 to 2007, the market price for stem bark ranged from Rs. 20 to Rs. 30 per kg, with a market demand exceeding 600 tonnes per year (Rawat et al., 2018). These statistics highlight the viability of *O. indicum* cultivation as a profitable venture, albeit one that requires long-term investment and strategic planning.

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EIACP ACTIVITIES

Van Mahotsav 2023

As part of AzadiKaAmritMahotsav (AKAM), Ek Bharat Shreshtha Bharat (EBSB) and Mission LiFE, EIACP (Environmental Information, Awareness, Capacity Building and Livelihood Programme) Programme Centre (erstwhile IFGTB ENVIS) RP at the ICFRE - Institute of Forest Genetics and Tree Breeding, Coimbatore celebrated Van Mahotsav 2023 by organizing a Tree Sapling Planting Programme on 6th July 2023. By creating and spreading awareness about the importance of tree planting and the role of individuals in environmental protection, this event aimed to empower people with the knowledge and motivation to make a positive impact on their surroundings by planting indigenous trees.

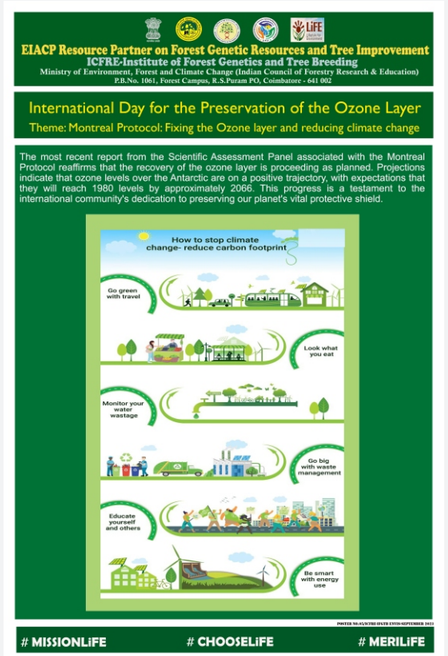
Saplings of *Terminalia bellirica, Ficusracemosa, Mimusopselengi, Calophylluminophyllum, Sapindusemarginatus, Syzygiumcumini, Neolamarckiacadamba, Madhucalongifolia and Mitragynaparvifolia* were planted in the Botanical Garden by officers, staff members and students of Arts and Science Colleges, Coimbatore. As part of the celebrations, drawing competition on the theme "Significance of planting Indigenous tree species" were conducted in which people from different walks of life participated. Certificates were awarded to the participants. Copies of the poster and handouts of the awareness poster were distributed to the school children in and around Coimbatore. Softcopy of the awareness poster and handouts were shared electronically to various stakeholders.

Mangrove Day 2023

As part of AzadiKaAmritMahotsav (AKAM), Ek Bharat Shreshtha Bharat (EBSB) and Mission LiFE,EIACP (Environmental Information, Awareness, Capacity Building and Livelihood Programme) Programme Centre (erstwhile IFGTB ENVIS) RP at the ICFRE - Institute of Forest Genetics and Tree Breeding, Coimbatore organized an awareness event on 26th July 23 to commemorate International Day for the Conservation of the Mangrove Ecosystem 2023. The main aim of this event was to raise awareness about the significance of mangrove ecosystems and to promote solutions for their sustainable management and conservation. As part of this commemoration, an awareness quiz was conducted from 10th July 2023 to 25th July 2023, in which people from different walks of life participated. E certificates were awarded to all of them. An awareness poster highlighting the significance of mangroves was also released during the occasion. Copies of the awareness poster and handouts were distributed to students and the general public and also the softcopies were electronically transmitted to various stakeholders.

International Day for the Preservation of Ozone Layer 2023

As part of Mission LiFE and in connection with International Day for the Preservation of the Ozone Layer 2023, EIACP (Environmental Information, Awareness, Capacity Building and Livelihood Programme) Programme Centre (erstwhile IFGTB ENVIS) RP at the ICFRE - Institute of Forest Genetics and Tree Breeding, Coimbatore organized awareness campaigns. The main aim of these events were to raise awareness about the significance of ozone layer among students and the general public. As part of this commemoration various awareness campaigns and activities were conducted to school students, college students, leading industries and general public. A lecture series for students for PSG College of Arts & Science, Coimbatore, Avinashilingam Deemed University, Coimbatore and S.T Hindu College, Nagercoil were organized. In addition, photography competition on the theme “Adaptation of LiFE Mission activities in household” was conducted from 01st September to 15th September 2023 in which people from different walks of life participated. E certificates were awarded to all of them. An awareness poster highlighting the significance of current year's theme was also released during the occasion. Copies of the awareness poster and handouts were distributed to students and the general public and also the soft copies were electronically transmitted to various stakeholders.



Mission LiFE Activities

Under Mission LiFE, ICFRE-IFGTB EIACP conducted awareness campaigns to various school & college students, industries, Government sectors, petrol pumps and other stakeholders. A total of 60 activities has been conducted by covering 11567 participants from different walks of life. Awareness materials were disseminated and tips to follow LiFE style were provided. In addition, MoEFCC PRAKRITI programme was conducted in Government higher Secondary School, Velankuruchi, Government High School, Kanuvai and Ammaniammal Higher Secondary School, Coimbatore. Various lectures were delivered to the students.

ICFRE - IFGTB PRODUCTS

ICFRE - INSTITUTE OF FOREST GENETICS AND TREE BREEDING

(Indian Council of Forestry Research and Education)

(An autonomous body of Ministry of Environment Forest & Climate Change, Govt. of India)
P.B. No. 1061, R.S. Puram, Coimbatore - 641 002. Tamil Nadu, India

The following Services are provided at ICFRE - IFGTB for various stakeholders. Please contact us for details as below.

	Services	Cost per unit		Contact Number with Email ID
Clonal Seedling: For Sale & Booking				
1.	Clones of Casuarina Hybrids (CH-1, CH-2 & CH-5)	Rs. 4.50 per plant		**Smt. K. Shanthi, CTO,** Division of Plant Biotechnology, Phone : 0422 2484122 E-mail : shanthik@icfre.org
	Eucalyptus clones (EC-4, EC-6, EC-9 & EC-11)	Rs. 4.00 per plant		
2.	Tissue Culture Teak Plants Bomboo Plants	Rs. 55.00 per plant Rs. 25.00 per plant		**Dr Rekha R. Warrier,** Scientist - F & Head, Division of Chemistry & Bioprospecting Phone : 0422 2484167
3.	Windbreak Clones (WBC-1, WBC-2, WBC-3 & WBC-4)	Rs. 4 per plant		**Dr. C. Buvaneswaran,** Scientist - G, Sliviculture & Forest Management Division, Phone : 0422 2484198, 94422 45047 E-mail : buvanesc@icfre.org
4.	ArborEasy® DNA Isolation Kit **Pack Size**	**Price Rs.**	**Packaging & Transportation Rs.**	**Dr. Modhumita Dasgupta,** Scientist - G, Division of Plant Biotechnology Phone : 0422 2484115 E-mail : ghoshm@icfre.org gmodhumita@gmail.com
	10 Reactions	950.00	150.00	
	20 Reactions	1900.00	200.00	
	50 Reactions	4750.00	300.00	
5.	Soil Testing (pH, EC, OC, Micro and Macro Nutrients)	Rs. 4750.00		**Dr. A.C. Surya Prabha,** Scientist - D, Sliviculture & Forest Management Division, Phone : 0422 2484150 E-mail : acsuryaprabha@icfre.org
6.	Phytosanitary Certificate	Rs. 100.00 + Tax per application		**Dr. John Prasanth Jacob,** Scientist - G, Forest Protection Division, Phone : 0422 2484157 E-mail : jacob@icfre.org
Products of IFGTB: For Sale & Booking				
7.	Hy-Act (Natural and Seed Oil Based Biopesticide)	Rs. 80.00 per bottle		**Dr. N. Senthilkumar,** Scientist - F Phone : 0422 2484193 Mobile : 9629160703 E-mail : senthilnk@icfre.org (or) **Smt. R. Sumathi,** CTO Division of Chemistry & Bioprospecting, Phone : 0422 2484144 Mobile : 9942245542 E-mail : sumathir@icfre.org
	Tree PALH (Natural and Seed Oil Based Biopesticide)	Rs. 80.00 per bottle		
	Crawl clean (Plant Based Green Insecticide)	Rs. 25.00 per packet		
	Tree Rich Biobooster (Instant Organic potting mixture for home garden, terrace and kitchen garden)	Rs. 50.00 per packet		
	Tara Red Jam (with natural fruit colorant)	Rs. 60.00 per bottle		