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VAN VIGYAN

INSTITUTE OF FOREST GENETICS AND
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From the
Director's Desk

Welcome to another newsletter from IFGTB!

We at IFGTB have been focussing on providing quality education and capacity building along with research support to strengthen forest science. This newsletter is one such medium which brings to you the latest developments in the field of genetics and tree improvement. This issue gives a detailed account of Jamun (*Syzygium cumini*). IFGTB has developed a low-cost high-efficiency DNA isolation kit, the details of which are given here. The ENVIS website (<http://www.ifgtbenvis.in/>) has taken upon itself a new task of hosting genomic information on different tree species. We request the readers who have information in this area to please contribute. We shall be glad to host the information in our database. I thank the ENVIS team for their support towards the preparation of this newsletter.

Mohit Gera
 Director, IFGTB

Know your trees - *SYZYGIIUM CUMINI* (L.) Skeels.

Introduction

Syzygium is the largest genus of Myrtaceae with an estimate of 1200 species in the world. The name *Syzygium* was adopted by Gaertner (1788) from Browne's (1756) genus *Suzygium*, but with a corrected spelling. Its etymology is from the Latin *Syzygia* and from the Greek *Syzyges* which means "Yoked together". Browne (1756) probably coined the new generic name in allusion to the paired arrangement of the leaves and branches (Craven and Biffin 2010). In the *Species Plantarum*, Linnaeus (1753) treated five species that were currently accepted as *Syzygium* in three separate genera: *Caryophyllus* L., *Eugenia* L. and *Myrtus* L. Although, the oldest name representing *Syzygium* is *Caryophyllus* the former name was conserved against the latter because it was widely used (Farr and Zijlstra 2014). The genus is well represented in evergreen and shola forests of Indian sub continent especially in high ranges of Western Ghats and North Eastern region. The genus forms very significant part of endemic flora of India. There are several species



which are economically important and traded in markets, which include clove (*Syzygium aromaticum*) fruits like *rosechampa* (*S. aqueum*) jamun or black plum (*S. cumini*), *S. jambos* and *S. malaccense* etc. *S. cumini* (L.) is a widespread species found in the wild and in cultivation. It is an evergreen, medium to large sized, fast growing tropical tree and well known as jamun or jambolana for its various uses as medicine, wood fuel, food fruit, pharmaceuticals, ornamental etc. Almost all parts of the tree are considered highly important.

Taxonomy

Medium-sized trees, the heights of fully matured trees vary from 15 to 40 m with the trunk girth of 0.5-2.5 m diameter. The bark on the lower portion of the stem is rough, cracked, flaking and discoloured, while it is light grey to gray or greyish-brown and smooth bowed in the upper portion. Usually, the colour of blaze is light pinkish-white. The leaves are ovate, oblong, base acute, apex long-acuminate; The leathery, glabrous and glossy leaves vary from 6 to 12 cm in length and 3.5 to 7 cm in width and there are many closely pararell secondary nerves, shining above. The flowers are a few to 40 in number borne on terminal or auxiliary panicle. The fruit is a berry, 10 x 7 mm in size; obovoid and deep violet blue in colour.

Distribution

Syzygium cumini originated in the Indian Subcontinent (India, Bangladesh, Myanmar, Nepal, Pakistan and Srilanka) and its other adjoining region, such as Indonesia. *S. cumini* is one of the most commonly distributed trees of India, a major component in all forest types, except in very arid regions. It thrives well in both moist and dry situations from sea level to hills up to 1200 m in

Himalayas and 1800 m in the Nilgiris. The species is commonly found on deep, rich, well drained soils in area witnessing a mean annual rainfall between 900 and 1000 mm. It grows abundantly in areas of heavy rainfall and grows well on river banks.

Phenology

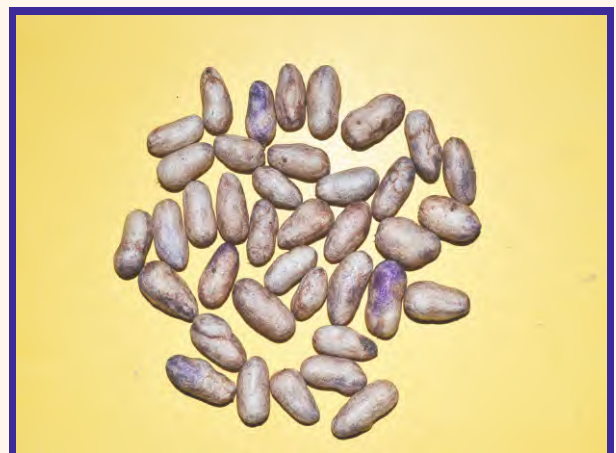
Flowering in jamun takes place in March and April. Flowers are bisexual. The inflorescence is terminal or lateral and develops mostly on one-year-old shoots and older branches. Before opening, the flower bud attains a size of 5.2 mm in length and 5 mm in diameter and requires 28-30 days from the appearance of the flower bud till the opening of flowers. The pollen grains are triangular in shape. The jamun is predominantly a cross-pollinated crop. The pollination is done by honey-bees, houseflies and wind. The maximum fruit set is obtained when pollination is done one day after anthesis and thereafter, setting of fruit decline sharply (Mishra and Bajpai 1975).

The maximum anthesis (18.71% - 43.08%) and dehiscence occur between 10 am and 12 noon. The pollen fertility is higher in the beginning of the season. The maximum receptivity of stigma is observed one day after anthesis. The highest level of pollen germination in jamun was obtained in 20% sucrose solution (Singh, 1978). Insects such as the honeybee and housefly are most active at noon. The housefly is active for a longer period than the

honeybee, and its frequency of visits is also higher. Maximum insects were active between 11 am and 3 pm during the day.

In most of the habitats, the fruiting starts in May and bunches of young fruits appear after 15-25 days from fruit initiation. Unripe fruits appear about 30-40 days after flowering. The fruits are green at first, turn from green to light violet-red or purple-red, and then dark purple or nearly black as they ripen. Fruits take about two weeks to change their colour from green to complete black. Ripening of fruits occurs between June & July and may extend up to August. Shedding of fruits starts when fully mature. The fruits are eaten by some birds, monkeys, squirrels, and human beings; therefore, they are widely dispersed.

Seed Collection



The jamun fruits should be harvested immediately when it becomes purple to black. It can't be retained on the tree at ripe stage. The fruits are picked singly by hand and necessary care should be taken to avoid damage of fruits. *S. cumini* fruits are harvested daily and the average yield of full grown seed lot is about 80 - 100 kg and from grafted one is 60-70 kg per year. Athani *et al.* (2009) recorded maximum yield in strain GLH -85 (200kg/plant).

Propagation

Seed propagation is the most common method of propagation. The seeds are viable for only 20 days in ambient temperature, they do not withstand chilling below 10° C. Chilling temperatures are known to adversely affect the viability of seeds of tropical origin (Chin *et al.*, 1989; Bedi & Basra 1993). At 0 - 5° C *S. cumini* seeds completely lost their viability within

20 days (Anandhalakshmi *et al.*, 2005). Jamun seeds are recalcitrant in nature; hence, fresh seeds can be sown 4-5 cm deep in the nursery within 10-15 days. The seeds germinate 10-15 days after sowing. If the seeds were sown too deep, seedling emergence is delayed and there may be some rotting due to poor aeration. Seeds may also be sown in polythene bags, as this facilitates easy handling of rootstocks and grafted plants. The seeds of jamun took longer time for germination under Bihar condition (Singh and Thakur 1977). Studies revealed that seed extraction of jamun after heaping the fruits for a single day was better for getting good-quality seeds than extraction of seeds immediately after collection (Srimathi *et al.*, 2003). Sasthri *et al.* (2001) recorded that large-sized seeds had a higher germination percentage (98% - 99%) than small-sized seeds (79% - 89%).

Seed viability, seed germination in response to various presowing treatments, and polyembryony were studied, seeds stored at low temperature showed 100% viability for about four months. Acid (H₂SO₄) scarification for 10 min duration resulted in better germination percentage in both diffused light and dark conditions (Stephens *et al.*, 2012)

Various soaking, chemical and growth regulator treatments were found increasing the germination and seedling growth of *S. cumini*. Germination was enhanced by IBA treatment-soaking in 100 ppm IBA for 12 or 24 h increased germination to 65% - 67%. Seedling growth and vigor were also increased by the IBA treatment (12 h was the best period) and by 12 h soaking in 1% NaH₂PO₄ (Vanangamudi *et al.*, 1999).

Germination of *S. cumini* seeds started on 3rd day and completed on 13th day of after sowing. Minimum one embryo and maximum 9 embryos were recorded.

S. cumini being a recalcitrant seed with high moisture content, the tendency of immediate germination exists. There is occurrence of



polyembryony in jamun to the extent of 20% - 50%; hence, nuclear seedlings may be utilized to produce true-to-type plants. With high metabolising tissues, the process of polyembryony appears to set in to enable survival of future generations. (Kunhikannan and Warriar 2017).

It can also be propagated vegetatively through cuttings, air-layering, grafting and budding through



cuttings. Semi-hardwood cuttings, treated with growth-promoting hormones have given 20% success and have grown well. Budding onto seedlings of the same species has also been successful. Veneer-grafting of scions from the spring flush has yielded 31% survivors. When a small-fruited, seedless variety in the Philippines was budded onto a seeded stock, the scion produced large fruits, some with seeds and some without seeds (Hong *et al.*, 1996). Approach-grafting and inarching are also practiced in India. Air-layers treated with 500 ppm Indole Butyric acid have rooted well in the spring (60% of them) but have died in containers in the summer (Hong *et al.*, 1996).

Silviculture and Plantation Management

The land is prepared by ploughing, harrowing, and levelling. There should be a gentle slope to facilitate proper irrigation and prompt drainage to avoid the harmful effects of water stagnation during the rainy season. Jamun can be grown under various cropping systems, an orchard crop in a pure land or as agroforestry species in mixed cropping systems. After marking the places for the plants, pits of 90x90x90 cm are dug out during the summer months.

The planting should preferably be done during cloudy day and in the evening. The plants should be irrigated immediately after planting. In the initial two or three years, it is advisable to protect plants against low-temperature injury by covering them with some sort of cover, leaving the south-eastern side open for the entrance of light. Jamun is planted at a distance of 10x10 m. It is normally planted along land borders, canal banks field boundaries, village groves, or home as scattered tree.

Agroforestry practices

S. cumini has been cultivated in the boundaries of farmlands and it has shown good potential for



commercial fruit production in farm forestry plantations. It is preferable to plant in the forest, non forest, wastelands and community lands.

Soil and climate

Jamun can thrive on a variety of soils in low, wet areas and on higher, well-drained land (loam, marl sandy soils, and calcareous soils). It grows well in area receiving heavy rainfall between 1500 and 10,000 mm per annum. It grows luxuriantly in regions of heavy rainfall, as much as 1000 cm annually. In India, it is usually found in areas receiving 900-5000 mm. The mean relative humidity in July varies from 70% to 100%, and in January from 40% to 90%. It also grows well on well-drained soils and once established can tolerate drought. It prospers on riverbanks and has been known to withstand prolonged flooding. It also tolerates drought after it has achieved some growth (Morton, 1987).

Insect pest & disease

There are several pests and diseases reported in this species. The important ones are:-

Leaf-eating caterpillar (*Corea subtilis*): This caterpillar is a serious pest that defoliates the tender leaves of young growing plants. As a result, the tree loses its vitality and the yield declines.

Bark-eating caterpillars (*Inderbela tetraonis* and

Inderbela quadrinotata): The larva feeds on the live bark tissues and shelters under the covering of silken webbing during night. Later, it makes a tunnel into the branch and stem and remains in the hole during daytime. As a result, the trees loses its vitality and yield declines.

Fruit borer (*Meridarchis reprobata*): The caterpillars bore into the fruits and feed within, rendering the fruits unfit for consumption.

Leaf miner (*Acrocercops syngamma* and *Acrocercops phaeospora*): This pest causes damage during April to September. The newly hatched caterpillar mines a narrow thread like silvery gallery on the leaf along the midrib upward or laterally. The larval mine is later transformed into tubular blister-like swelling on the dorsal surface of the leaf.

Leaf roller (*Polychorosis cellifera*): The larvae web the leaves by folding the tip, downward on both margins parallel to the midrib and feed inside. In the case of a severe attack, one-fourth of the lamina is eaten up. The pest undergoes three to four generations between March – April and September – October in North India and the second generation is most harmful (Lakra, 1997).

Leaf webbers (*Aryroploce aprobola*): The newly hatched larvae in large numbers web together the tender leaves at shoot tips and feed within (Lakra, 1997).

Disease: The fungus anthracnose (*Glomerella cingulata*) incites leaf spot and fruit rot. Affected leaves show small-scattered spots, light brown or reddish-brown in color. Affected fruits show small, water-soaked, circular and depressed lesions.

Wood Properties and Utilization

S.cumini wood has a specific gravity of 0.77 and burns well, giving off about 4,800 kcal/kg. It is a fast-

growing tree, which provides excellent firewood and charcoal. The reddish-grey or reddish-brown heartwood is fine grained and utilized in exterior joinery and carpentry. Wood is durable in water, resistant to termites, and although difficult to work, it saws and machine well and is used for construction, boat building, commercial tea and chest plywood, agriculture implements, tool handles, cart wheels, well curbs and troughs, sleepers, furniture and as props for shafts and galleries in mines. It is also used for building bridges and for making musical instruments, especially guitars (Luna, 1996; Mbuya, 1994).

Medicinal Uses

S. cumini received for more recognition in folk medicine and in the pharmaceutical trade than in any other field. Medically, the fruit is stated to be astringent, stomachic, carminative, antiscorbutic and diuretic. Cooked to a thick jam, it is eaten to all acute diarrhea. The juice of the ripe fruit or a decoction of the fruit, or jambolana vinegar is administered in India in cases of enlargement of the spleen, chronic diarrhea and urine retention. Water-diluted juice is used as a gargle for sore throat and as a lotion for ringworm of the scalp.

The seed and bark are much used in tropical medicines and are shipped from India, Malaya and Polynesia and to a small extent, from the West Indies, to pharmaceutical supply houses in Europe. Extracts especially the seeds, in liquid or powdered form, are given orally, 2 to 3 times a day, to patients with diabetes mellitus or glycosuria. In many cases, the blood sugar level reportedly reduced and there were no ill effects. However, in some quarters, the hypoglycemic value of jambolana extracts is disclaimed. In experiments at Central Drug Research Institute, Lucknow, the dried alcoholic extract of jambolana seeds given orally, reduced blood sugar and glycosuria in patients (Mbuya, 1994).

The leaves, steeped in alcohol, are prescribed in diabetes. The leaf juice is effective in the treatment of dysentery, either alone or in combination with the juice of mango or emblic leaves. The leaves, stems, flower buds, opened blossoms, and bark has antibiotic activity. A decoction of the bark is taken internally for dyspepsia, dysentery, diarrhoea and also serves an enema. The root bark is similarly employed. Bark decoctions are taken in cases of asthma and bronchitis and are gargled or used as mouthwash for the astringent effect on mouth ulcerations, spongy gums, and stomatitis. Ashes of the bark, mixed with water, are spread over local inflammations, or, blended with oil, applied to bums. In modern therapy, tannin is no longer approved on burned tissues because it is absorbed and can cause cancer. Excessive oral intake of tannin-rich plant products can also be dangerous to health (Noad and Birnie, 1989).

Genetic variability

Vast genetic and species diversity exists in the genus *Syzygium* in India. Being a cross-pollinated fruit crop, *S. cumini* is highly heterozygous and seedling exhibits a wide range of variations which eventually help in the selection of superior genotypes with desirable horticulture traits. Propagation through seeds also brings much of the desired variability in jamun germplasm. A number of jamun seedling strains with considerable variation in fruit shape and size, pulp color, total soluble solids (TSS), acidity and earliness were reported from Uttar Pradesh, Gujarat, and Maharashtra. This enormous diversity provides ample scope for selection of desirable genotypes and cultivars diversity uses (Malik *et al.*, 2017). Based on the growth habit, leaf apex, leaf base, mature fruit, shape, mature fruit apex, stalk end, fruits length, breath and pulp the DUS test guidelines have been developed.

Based on the population diversity *S. cumini*

germplasm has been collected through India especially from the States of Maharashtra, Rajasthan, Gujarat, Uttar Pradesh, Haryana, West Bengal and also in the Western Ghats regions, different aspects of variability in fruiting, flowering period, fruits characters and tree phenology has been documented. The selected germplasm has been characterized and some of the genotypes are being maintained in the field gene banks at Indian Council of Agricultural Research (ICAR) institutes and State Agricultural Universities (SAUs) (Malik *et al.*, 2017).

Germplasm conservation

Conservation of horticultural genetic resources and specially the underutilized fruit species, some of which are still grown in wild and semi wild conditions, would require adoption of complementary conservation strategies involving suitable *in situ* and *ex situ* conservation methods. Germplasm conservation of a diverse genus like *Syzygium*, with several species and vast genetic variability spread over the arid to lower hills of the Himalayas to the Western Ghats and Northeast India, is indeed a challenging task, which needs special effort with dynamic strategies. Traditionally, germplasm conservation is practiced using *ex situ* and *in situ* conservation methods, where depending on the biological status, extent of diversity available, and propagation method, one or both strategies are recommended to be employed.

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Arbor Easy® DNA Isolation Kit

Deoxyribose nucleic acid (DNA), is the unit of life containing genetic instruction for development and functioning of predominantly all life forms. Isolation of high quality, intact DNA is the first most critical step in performing many fundamental molecular biology experiments. The presence of large amounts of contaminating biomolecules in complex mixtures often impedes isolation, recovery and downstream processing of DNA. In tree tissues isolation of DNA is highly challenging and recovery is often low using commercial kits developed for universal purpose.

Product description: ArborEasy® DNA Isolation Kit provides an indigenous, non-biohazardous, low cost spin column based system for isolation of plant genomic DNA from wide range of tissue types, specifically challenging tissues from tree species. The protocol quenches polyphenols, polysaccharides and other bio-contaminants to facilitate high recovery of un-degraded genomic DNA. This technology was developed based on IFGTB-DBT joint patent. ArborEasy® is a registered trademark of IFGTB, Coimbatore, India.

Kit Validation: The performance of the kit was validated at Bharathiar University, Coimbatore; IWST, Bangalore; KFRI, Peechi and CSIR-IICB, Kolkata. It was tested on casuarinas, eucalypts, teak, sandalwood, ficus, hevea, oil palm, rice, cotton, tomato, tobacco and the tissue samples tested included Fresh/ silica dried leaves, roots, stem, wood, needles.

Competitive advantage

- ❖ Rapid procedure with ease of handling
- ❖ Free from hazardous chemicals
- ❖ High recovery of un-degraded DNA
- ❖ Isolation of DNA from highly fibrous and dried plant tissues
- ❖ Effective on tissues rich in polyphenols or polysaccharides



DNA isolated using ArborEasy™ DNA Isolation kit
 Kit launched on 24 January 2018 by
 Dr. Meenakshi Munshi, Scientist G & Adviser,
 Department of Biotechnology,
 Government of India at IFGTB.



- ❖ Cost effective when compared to similar products commercially available

Field of application: The DNA isolated from the kit can be used in the following experiments:

- ❖ Routine PCR analysis
- ❖ (RAPD/ISSR/AFLP assays)
- ❖ High-throughput marker assays (SSR/InDel/SNP/HRM genotyping/Barcoding)
- ❖ Next generation sequencing (WGS /Amplicon sequencing/Target capture)
- ❖ SNaPshot analysis

The kit was developed by Dr Modhumita Dasgupta at IFGTB, Coimbatore.

National Conference on "Towards Resilient Ecosystems: The Role of Forestry Research"

Institute of Forest Genetics and Tree Breeding, Coimbatore organized a National Conference on "Towards Resilient Ecosystems: The Role of Forestry Research" during 8 and 9, May 2018. The objective of the Conference was to have scientific deliberations and discussions on the subject of "Ecosystem Resilience" which is the need of the hour for ensuring sustainable flow of forest ecosystem services. The conference also aimed to review and revisit Research and Development initiatives taken by various State Forest Departments and Research Organizations on the subject of Forest Ecosystems Resilience. About 100 senior officers from 11 different State Forest Departments, Deans and Professors from Forest Colleges, Directors and scientist from all the ICFRE institutes and scientists from other institutions, NGOs and Tree Growers attended the conference.

In the Inaugural function, Dr Mohit Gera, IFS, Director, IFGTB welcomed the dignitaries and delegates and gave an overview of the Conference. Shri. S.D. Sharma, IFS, Dy. Director General (Research), ICFRE also addressed the gathering. Key Note address was delivered by Dr S. C. Gairola, IFS, Director General, ICFRE, Dehra Dun. The Conference was inaugurated by Shri. Siddhanta Das, IFS, Director General of Forest & Special Secretary to GoI, MoEF & CC, as Chief Guest of the Conference and a Conference Compendium was released by him. The Chief Guest also distributed appreciation Certificate to the inventors of two patents in by IFGTB. Dr S. Murugesan, Scientist-G, Group Co-ordinator (Research) and Convener of the Conference proposed the vote of thanks while ending the inaugural session of the Conference.

The conference was deliberated on five sessions namely i) Vulnerability Assessment, ii) Tree Improvement and Biotechnological Strategies for Climate Resilience, iii) Harnessing Forest Genetic Resources For Climate Resilience and Forest Health,

iv) Adaptive Forest Management: Issues And Challenges and v) Climate-Smart Forestry: Research and Management. There were 5 lead talks and 10 invited talks delivered and discussed in the conference. The Lead talks were presented by Dr Rajiv Kumar Chaturvedi, Senior Researcher, IISc, Bangalore, Dr James Jacob, Director, Rubber Research Institute, Kottayam, Kerala, Dr Z. Abraham, Scientist (Retd), NBPGR, Dr C.T.S. Nair, Former Chief Economist, FAO Forestry Department and Dr M.H. Swaminath, IFS, PCCF (Retd.), SFD, Karnataka. The invited talks were from Dr A. Ramachandran, IFS, Professor – Emeritus, Anna University, Chennai, Dr A. Nicodemus, Scientist-F & Head, Genetics & Tree Breeding Division, IFGTB, Dr R.V. Varma, Former Chairman, Kerala State Biodiversity Board, Kerala, Dr T. Sekar, IFS, Former PCCF, Tamilnadu State Forest Department, Chennai, Shri. T. Rabikumar, IFS, Secretary, National Biodiversity Authority, Gol, Ratnakar Jauhari, IFS, CCF, Andhra Pradesh, State Forest Department, Dr G. Chandra Shekar Reddy, IFS, APCCF, Hyderabad, Dr K.N. Murthy, IFS, PCCF & MD, Karnataka State Forest Industries Corporation Ltd. and Dr Jagmohan Sharma, IFS, APCCF, Karnataka State Forest Department. Finally, Wrap-up session was held for drafting of Recommendations under the chairmanship of Dr S.C. Gairola, IFS, Director General, ICFRE, Dehra Dun and Dr Mohit Gera, IFS, Director, IFGTB Co-chaired the session. Recommendations from all the technical sessions were discussed and drafted. The draft recommendations will be sent to ICFRE for approval and onward submission to MoEF&CC, GoI. This will help in policy making on the important subject of making the forestry ecosystems resilient to the changing climate. On concluding of the Conference, Dr C. Buvaneshwaran, Scientist-F & Organizing secretary of the Conference proposed the vote of thanks.



Inauguration of the Exhibition on ICFRE Technologies



Shri. Siddhanta Das, IFS, DGF& Spl Secy, MoEF&CC reviewing the ICFRE Technologies



Welcome address by Dr Mohit Gera, IFS, Director, IFGTB



Delegates during Inaugural session



Release of Compendium by Shri. Siddhanta Das, IFS, DGF& Spl Secy, MoEF&CC



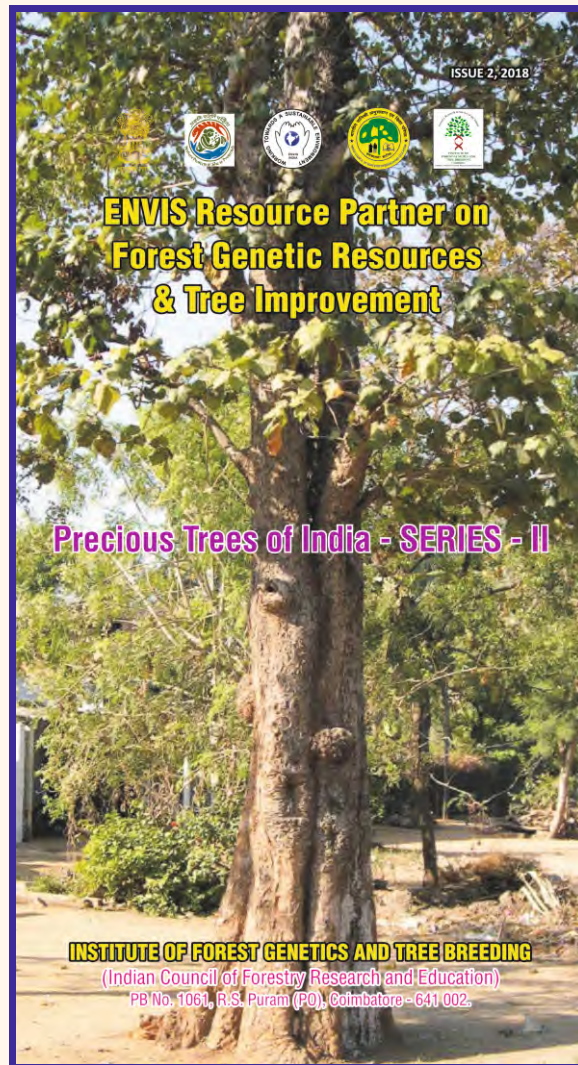
Inaugural Address by Shri. Siddhanta Das, IFS, DGF& Spl Secy, MoEF&CC



Key Note Address by Dr S.C. Gairola, IFS, DG, ICFRE

'INTERNATIONAL DAY FOR BIOLOGICAL DIVERSITY'

ENVIS Resource Partner on Forest Genetic Resources and Tree Improvement at IFGTB Coimbatore observed the International Day for Biological Diversity on 22nd May 2018 at IFGTB. The programme started with an invocation on Nature in Sanskrit by Dr Kannan CS Warriar, Scientist F and Coordinator ENVIS. Dr R.V. Varma, former Chairman of Kerala State Biodiversity Board gave an invited lecture on Biological Diversity Act, 2002 and Rules, 2004 and its Relevance to Biological Research and Development. Dr Mohit Gera, IFS, Director IFGTB and Dr S Murugesan, Group Coordinator Research IFGTB also spoke during the occasion. A brochure on Precious Trees of India Series II developed by the IFGTB ENVIS was released.



'WORLD ENVIRONMENT DAY - 2018'

IFGTB ENVIS Resource Partner on Forest Genetic Resources and Tree Improvement observed the 'World Environment Day' on 05th June -2018 at Corporation School, Lingagoundanputhur, Coimbatore to create awareness among the students on the plastic pollution and conservation and importance of forest trees. The programme was inaugurated by Mrs. N. Anitha, Head Mistress, Dr T. Vamadevan Information Officer and Mr. V. Thangavel IT Officer, IFGTB ENVIS participated in the event. An awareness poster on the theme was released during the occasion.



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 Institute of Forest Genetics and Tree Breeding (Indian Council of Forestry Research & Education)
 PB No. 1061, Forest Campus, R.S. Puram PO, Coimbatore - 641 002

WORLD ENVIRONMENT DAY 2018

05, JUNE 2018

BEAT PLASTIC POLLUTION

9/10 of the world's sea birds are likely to have pieces of plastic in their guts.

Worldwide approximately **400 million** tonnes of plastics produced per year

46,000 pieces of plastics in every square mile of ocean

Around the world, plastic soft drink and water bottles are produced at the rate of **20,000** per second.

18% of plastic is recycled and one third of plastics directly enter in to the environment (roadside or into streams, lakes and oceans).

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WORLD ENVIRONMENT DAY 2018

05, JUNE 2018

10 WAYS TO USE LESS PLASTIC EVERY DAY

➤ Avoid buying items packaged in plastic

➤ Repair or upgrade electronic devices instead of buying new ones

➤ Use cloth shopping bags say no to plastic bags

➤ Think of new uses for old items rather than discarding them or buying new ones

➤ Say no straw please

➤ Skip bottled water carry a reusable container

➤ Wear clothing made from natural (not synthetic) material

➤ Use reusable cups

➤ Avoid disposable plastic cups, plates

➤ Take own container for takeout and leftovers

ABOUT IFGTB

Institute of Forest Genetics and Tree Breeding (IFGTB), Coimbatore is a National Research Institute under the Indian Council of Forestry Research and Education. 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 ENVIS

ENVIS established by the Government of India, in 1982 has been on 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 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.

INSTRUCTIONS TO CONTRIBUTORS

Dear Author/Subscriber/Contributor,

We invite contributions to the ENVIS Newsletter issues! The ENVIS Resource Partner at IFGTB focuses on Forest Genetic Resources and Tree Improvement. It aims to act as a window for quality scientific publications and a forum for presenting your thinking on the challenges in the fields of FGRs and tree improvement. The ENVIS Newsletter, Van Vigyan, a quarterly publication, publishes original research articles, reviews, reports, research highlights, news-scan etc., related to the thematic area of the ENVIS Resource Partner. Original research and review articles, notes, research and meeting reports are invited for the newsletter. Details of forthcoming conferences / seminars / symposia / trainings / workshops also will be considered for publication in the newsletter. Articles may be sent in Times New Roman (with font size 12) in double spacing with a maximum of 5-6 typed pages. Photographs/line drawings and graphs need to be of good quality with clarity for reproduction in the newsletter. Only electronic submission will be accepted.

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

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Views expressed in this newsletter are not necessarily those of the Editors or of the Institute of Forest Genetics and Tree Breeding