



ENVIS Newsletter Forest Genetic Resources & Tree Improvement

VAN VIGYAN

INSTITUTE OF FOREST GENETICS AND TREE BREEDING
(Indian Council of Forestry Research and Education)



From the
Director's Desk

The ENVIS Resource Partner at IFGTB brings out precise information on forest genetic resources, their importance and utilization aspects, various tree improvement activities being carried out and species specific methodology to cultivate in large or small land holdings. We also try to collate and disseminate information in people friendly manner which would help research organisations, state forest departments, universities/colleges, wood based industries and farmers' groups. The present issues contain article on *Acacia nilotica*, a multi-purpose small timber species, information on celebration of days of international and national importance, educational and extension activities related to forest genetics and tree improvement. We look forward for feedbacks and suggestions.

Dr C. Kunhikannan
Director, IFGTB

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Know your trees - *Acacia nilotica* (L.) Willd. ex Del

Introduction

Acacia is a large woody genus, the generic name 'Acacia' comes from the greek word 'akis', meaning a barb or a point. Over 1000 species exist naturally in the world. The species *Acacia nilotica* (L.) Willd. ex Del belongs to family Fabaceae and is commonly known as Babul, Black Babul, Indian Gum (English), Karuvelamaram, Karuvelei. Velampisin (gum) (Tamil), arabic tree.

Taxonomic classification

Kingdom : Plantae
 Division : Magnoliophyta
 Class : Dicotyledonae
 Order : Fabales
 Family : Fabaceae
 Subfamily : Mimosoideae
 Genus : *Acacia*
 Species : *nilotica*



Distribution and habitat

Acacia nilotica is a medium sized, thorny, nearly evergreen tree that can reach up to 20-25 m height (Gupta *et al.*, 2020). This species grows naturally in southern tropical dry deciduous forests and southern tropical thorn forests. It is native of the Indian Sub-continent, Burma, Sri Lanka, Saudi Arabia, Tropical Africa, Egypt and West and East Sudan. One of the largest tracts was earlier found in Sind (Singhdoha *et al.*, 2017). In India it is distributed throughout forest areas, farmlands, agriculture fields, roadsides, tank foreshores, village grazing lands, bunds, waste lands, along the railway lines and the national highways. It mostly grows as an individual tree and is rarely found in patches (Singhdoha *et al.*, 2017).

Botanical description

A. nilotica is a tree with a dense spheric crown, stems and branches usually dark to black colored, fissured bark, grey-pinkish slash, exuding a reddish low quality gum. The tree has thin, straight, light, grey spines in axillary pairs, usually in 3 to 12 pairs, 5 to 7.5 cm long in young trees, mature trees commonly without thorns. The leaves are bipinnate, with 3-6 pairs of pinnulae and 10-30 pairs of leaflets each, tomentose, rachis with a gland at the bottom of the last pair of pinnulae. Flowers in globulous heads 1.2-1.5 cm in diameter, bright golden-yellow, set up either axillary or whorly on peduncles 2-3 cm long located at the end of the branches. Pods are strongly constricted, hairy,

white-grey, thick and softly tomentose. Its seeds number approximately 8000/kg.

Reproductive biology and breeding system

The bright yellow flowers in the round heads make *Acacia nilotica* easy to identify. Flowering is prolific, which happens a number of times per year. Phenologically the species passes through a brief deciduous phase of 28–36 days during winter (January-February) and a long and staggered flowering period of 161–189 days (Singhal *et al.*, 2008). Temperature and rainfall affects the flowering and fruiting in *A. nilotica*, generally peak flowering occurs during October-December and peak fruiting around April-June. Fruiting peaks in January, sometimes it occurs during June to September and December (Gupta *et al.*, 2020). It is andromonoecious and obligate outcrosser. In *A. nilotica*, 80–90% floral heads open during night (18.00–24.00 hr) and all the anthers in the flower dehisc synchronously the next morning between 8.00–12.00 hr. They produce compound 16-celled pollen grains (polyads) which are of Enterolobium-type with nectar in traces. Average pollen production is 1.1 million grains per inflorescence. Pollen viability in *A. nilotica* ranges from 58% to 65%; it may



decrease in storage condition from 43.75% to 3.12% and fails to germinate after 7 days. The storage of pollen grains affects pollen tube length also the length decreases from 120 μm to 9 μm . The plant is entomophilous, attracts a variety of insects to visit the floral heads during peak blooming. Pollination is achieved by the anther and/or pollen foraging bees (*Apis florea*, *A. mellifera*), wasps (*Polistes herbreus*) and butterflies (*Pieris brassicae*, *Danaus chryoppus*) & Some pollen grains are transmitted by wind, too. In *A. nilotica* number of ovules per ovary ratio are 1:1 (16 pollen per polyad and 16 ovules per ovary) indicating that the species has good pollination success (Singhal *et al.*, 2008). Less than 1/3 of the flowers are hermaphrodites and the pod set per hermaphrodite flower is 0.3 percent. The average seed set per pod is 10.8. One tree can produce more than 30,000 seeds in one fruiting season.



Fruit collection and processing

A. nilotica bears pods biannually, first in October to December and for a second time during January to May. Seeds are dark, black-brown and present in pods. The seeds are smooth, compressed, 7-8 mm in diameter with a hard seed coat. In moist localities seeds bigger

as compared to dry locality ranging from 5,000 to 16,000 seeds per kg (Fagg, 2001). The extracted seeds can be stored in gunny bags, tins or baskets in cool and dry place with good air circulation. If seeds are to be stored for a long time, they need to be completely air dried and kept in air tight containers.



Germination

A. nilotica seeds remain dormant for more than five years in the soil due to their impermeable “hard” seed coats (Brown and Carter 1998). Pre-sowing treatment on seeds of *A. nilotica* can improve the growth rate, development process and the dormancy. Hot water treatment (76.2%) is the best technique for seed germination (Gilani *et al.*, 2019). The seeds collected from goat/sheep pens do not need any further treatment. The treated seeds are sown in nursery beds either by broadcast sowing or by dibbling method. It can be also raised in polythene containers. Two or three treated seeds are sown in each container, about 1.5 cm deep during February-March. The soil mixture used in container bags consists of soil and compost in 2:1 ratio. Germination commences one to three weeks after sowing and is mostly completed in a month's time. The germination of the seed is epigeal.



Vegetative propagation

Vegetative propagation in *A. nilotica* is successful under mist chamber conditions. Success is reported in case of rooting of stem cuttings treated with indole acetic acid and indole butyric acid. Watering in the nursery should be done frequently, till the seed germination completes. On germination, 2-3 times watering in a week are sufficient. Young seedlings have to be weeded regularly for 2-3 months. Excess seedlings are removed so as to leave only one seedling in each polypot. Shade in the early stage should be provided for the proper development of seedlings. It is reported that shade increases the germination percentage. Shade is required during winter when there is a danger of frost and during summer when the temperature is too high. Seedlings are kept in the nursery under constant care until planting.



In vitro propagation

Epicotyls of germinated seeds of *A. nilotica* were used as explants and cultured in solidified Murashige and Skoog (MS) (1962) medium with different combination of benzylaminopurine, naphthalene acetic acid and gibberelic acid

(BA*NAA*GA3). The highest rooting percent 93.33% and longest stem 53.33 mm were found in epicotyls of *A. nilotica* seeds. (Samake *et al.*, 2011).



Insect pests and diseases

A wide range of pest and diseases affect *A. nilotica*. 71 insects are recorded in India. In 1930s dieback was reported in the Sudan. This was attributed to infestation by Sphenoptera chalcichroa arenosa, a cambial and wood boring beetle (El Atta and Nour, 1995). The larvae of this beetle tunnel into the cambium layer of *A. nilotica* branches and stems causing dieback and gradual tree casualty.

Bruchidius uberatus is primary pest of stored seed (El Atta and Nour, 1995). The adults lay eggs on the pods, and then the larvae bore into the seed, often completely destroying the seed and hence preventing germination. It is the primary infesting insect of *A. nilotica* and also infests a number of other Acacia species including *A. tortilis*, *A. mellifera*, *A. burkei*, *A. erioloba*, and *A. robusta*.

Vascular wilt disease in *A. nilotica* is caused by *Fusarium oxysporum*. It directly affects the seedlings and causes mortality in seedlings

raised in polythene bags (33.7%) than those in root trainers (16.9%). Soil is the main source of infection. It can be controlled by spraying bavistin and benlate at 0.1% concentration. Soil drenching with Thiram (0.05%), followed by seed dressing with Bavistin (0.05%) is also effective (Kapoor *et al.*, 2004).

The nymphs and adults of *Anomalococcus indicus* suck sap from stem and branches of seedlings and saplings, by piercing the plant tissue with their needle-like mouth parts. This scale insect can be recognized by its conspicuous dome-shaped dirty white to brown waxy covering over the body, secreted by the insect, which serve as protective covering of its soft body. The female insect lays 700 to 800 eggs inside large fluted ovisac below their body. The first instar nymphs are minute and light waxy yellow in colour. They are very active being the only mobile stage of the scale insect. The first instar nymphs crawl about for sometimes and after locating suitable site, it inserts the needle-like mouth parts inside the host tissue.

The excessive drainage of plant sap caused due to the infestation of the scale insect resulting shedding of foliage and dieback of branches. This black fungus covers the affected portion of the plant and accelerates the dieback process. The insect is polyphagous and reported to feed on *Acacia catechu*, *A. leucophloea* and *Ziziphus mauritiana* (Beeson, 1941).

Sinoxylon sp. is a dark brown beetle, 4 to 5 mm long and bores into green shoots and twigs of saplings for feeding. They make horizontal tunnels within the circumference of cambium layer of stem and branches, thus girdling these

parts. The affected parts break and the growth of the attacked parts get hampered. The infestation of leader shoots promotes branching. The incidence of attack is about 5%. The infestation starts in the month of June and it continues up to July.

Selepa celtis hairy caterpillars feed on leaves of seedlings kept in nurseries and saplings in young plantations. The pest is usually found during rainy season and they cause moderate to complete defoliation of plants by their gregarious feeding pattern. The life-cycle is completed in about 25 to 30 days.

Planting techniques and post planting operation

The seedlings of *A. nilotica* are generally planted in pits having the size of 30x30x30 cm. The most common spacing adopted for plantation is 4 x 4m. On road sides, deeper pits of the size of 45 x 45 x 45 cm are preferred. Mound planting is practiced where there is fear of water logging specially on dug up road sides. *A. nilotica* seedlings attain a height of 30 to 40 cm in a period of 6 months. To avoid casualties in plantation eliminate seedlings with damaged or diseased tops or roots and below the minimum standard size and root development. Direct sowing is one of the easiest and most common method for raising *A. nilotica* plantation in the field. Sowing (seed rate 2.5 – 3 kg/ha), dibbling in lines, patches or mound have given successful results.

Agroforestry practices

A. nilotica leaf litter decomposes easily and enhances the soil organic matter, which soil is

appropriate in agroforestry systems. In the sub-humid region of Chhattisgarh, *A. nilotica* + rice traditional agroforestry system has been followed (Viswanath *et al.*, 2000). In West Bengal silvipisciculture systems has been tried in mangrove areas.

Tree improvement

IFGTB carried out studies on the host plant resistance in two provenance trials of *A. nilotica* laid out in forest campus Coimbatore and Ilachipalayam, near Annur, Coimbatore. Out of the 30 seed sources of *A. nilotica* studied for susceptibility to key pests, *Anomalococcus indicus*, *Sinoxylon* sp. *Selepa celtis*, the seed source of Mathura origin was found to be free from infestation of all the pests.

Experiments conducted by IFGTB on biochemical parameters of these seed sources have revealed that the scale insect, *A. nilotica* had strong preference for plants with higher protein, carbohydrate and nitrogen content,



while the stem borer, *Sinoxylon* sp. exhibited less preference for plants with higher tannin content. The defoliator, *S. celtis* preferred seed sources with higher moisture content in the leaves (Sasidharan *et al.*, 2004). Based on the characters of economic value viz., straightness, self-pruning ability, clear bole height, low branching habit, disease resistance sixty candidate plus trees (CPTs) of *Acacia nilotica* were selected. Pods and seed parameters were estimated from various provenances.

Utilization

The leaves, roots, seeds, bark, fruits, flowers, gum and immature pods of *A. nilotica* are used as an anti-cancer, antimutagenic, spasmogenic, vasoconstrictor, anti-pyretic, anti-asthmatic, cytotoxic, anti-diabetic, anti-platelet agregatory, anti-plasmodial, molluscicidal, anti-fungal, inhibitory activity against Hepatitis C virus (HCV) and human immunodeficiency virus (HIV)-I and antioxidant activities, anti-bacterial, anti-hypertensive and anti-spasmodic activities, which contains phenolics, consisting of condensed tannin and phlobatannin, gallic acid, protocatechuic acid, pyrocatechol, (+) -catechin, (-) epigallocatechin-7-gallate and (-) epigallocatechin-5, 7-digallate and used in the indigenous system of medicine (Ali *et al.*, 2011).

A. nilotica seed flour is a potential source of oil and protein for food formulations, it contains 6.67% moisture, 2.80% ash, 23.33% crude fat, 6.53% crude fibre, 30.95% crude protein and 29.72% carbohydrate. The calorific value of the flour is 452.65 Kcal/100g. *A. nilotica* seed flour is a good source of essential minerals such as K,

Mg, Ca, P and Na with the most abundant of these being potassium (1168±62.36 mg/100g) and the essential amino acids such as arginine, leucine and phenylalanine were found (Ndamitso *et al.*, 2017).

A. nilotica is used as a substitute for fodder species under unfavorable conditions in dry areas. Their high crude protein (21.4%), crude fibres (30.12%), fats (24.77%), dry matter (93.71%), ash content (11.67%) (Abdalla *et al.*, 2014) shows high fodder value.

Acacia nilotica is used as a biofertilizer for enhancing the growth of tomato plants. Combinations of leaf and shoot powder completely controls the infection of *Macrophomina phaseolina*, *Fusarium solani*, and *F. oxysporum* (Parveen *et al.*, 2020).

A. nilotica is one of the major gum-yielding species. Analysis of physical, functional, morphological, and thermal properties of its gum shows that it is a free-flowing powder with 33% porosity. The major minerals like Ca, K, P, Mg, and Na were present in *A. nilotica* gum and the molecular weight of a major fraction of its gum is 0.99 ×10⁵ Da. It can be act as substitute for numerous applications in food and pharmaceutical industry. (Bhushette and Annapure, 2020).

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ENVIS ACTIVITIES

Swachh Bharat Abhiyan

IFGTB ENVIS organized an awareness programme on “Swachh Bharat” Abhiyan. The main objective of this awareness programme was to inculcate the value of cleanliness among all stakeholders for maintaining clean, green and healthy surroundings and to improve the quality of life of people. An awareness poster highlighting the vision and objectives of “Swachh Bharat Mission (Grameen) phase II” was released by Dr C. Kunhikannan, Director, IFGTB on 06.10.2020 during the Workshop on Prioritization of FGRs for Conservation and Development. Dr Kannan CS Warier, Scientist F and Coordinator ENVIS, Shri S. Senthilkumar, Group Coordinator Research, Shri K. Murali Sankaar, Head of Office, Dr R. Anandalakshmi, Head, Forest Genetic Resource Management and Dr S. Vigneswaran, Programme Officer, ENVIS were present during the release.



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SWACHH BHARAT ABHIYAN

Committed to building a Swachh and Swasth Bharat

To accelerate the efforts to achieve universal sanitation coverage and to put focus on sanitation, the Prime Minister of India had launched the Swachh Bharat Mission on 2nd October 2014. The mission was implemented as nation-wide campaign/Janandolan which aimed at eliminating open defecation in rural areas during the period 2014 to 2019 through mass scale behavior change, construction of house hold-owned and community-owned toilets and establishing mechanisms for monitoring toilet construction and usage.

VISION - PHASE II

The aim of Swachh Bharat Mission - Grameen is to ensure the open defecation free behaviours are sustained

Objectives

- Open defecation free (ODF) behaviours are sustained and no one is left behind.
- Solid and liquid waste management facilities are accessible and reinforcing ODF behaviours and focus on providing interventions for safe management of solid and liquid waste in villages.
- To encourage cost effective and appropriate technologies for ecologically safe and sustainable sanitation.
- To develop, wherever required, community managed sanitation systems focusing on scientific Solid & Liquid Waste Management systems for overall cleanliness in the rural areas.
- To create significant positive impact on gender and promote social inclusion by improving in marginalized communities.

Swachh Bharat Since 2nd October 2014

10,68,41,518 Household Toilets Built	706 Open Defecation Free Districts	63.3% of Rural population practicing Solid Liquid Waste Management (SLWM)	6,03,177 Open Defecation Free Villages	35 Open Defecation Free States/UTs
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Source: National Annual Rural Sanitation Survey (NARSS) 2015-18

Role of Citizen and Community

Change the mindset

Do not litter

Avoid plastics

Raise Awareness

Follow the 3 R Rule of environmental conservation

Plant more trees

Participate in cleaning activities

Share pictures of Impact

Wildlife Week 2020 Celebrations by IFGTB ENVIS

IFGTB ENVIS organized Wildlife Week 2020 Celebrations digitally through Facebook live on 07 October 2020. An online elocution competition was also conducted for students and public on the topic “Why do we need to conserve wildlife”. Results of the Online Elocution Competition held on the theme “Why do we need to conserve wildlife?” were declared. Among the 68 participants who took part in the contest from different states of India, Shri Supraja, 9th Grade, Prasan Vidya Mandir, Chengalpattu, Shri R Shreyas, UKG, GRD Public School Coimbatore and Shri D.K. Hansikaa, 6th Grade, Vidhya Niketan Public School, Coimbatore won the first, second and third prizes respectively. The next 06 best elocutions were awarded consolation prizes. Cash prizes were awarded to the winners and E Certificates to all the participants. An awareness poster highlighting the importance of wildlife conservation was released during the occasion and its digital copies were shared with students and all the stakeholders. The online event can be accessed at <https://bit.ly/33A4u8s>.

WILDLIFE WEEK
OCTOBER 2-8, 2020

Wildlife is a precious gift to this planet from nature, which includes animal and plant species as core components of the World's Biodiversity. The main focus of wildlife week celebration is to develop healthy and favourable environment for animals and plants and also to preserve them. National Wildlife Week is a time to celebrate the amazing wildlife of our country. Conserving and protecting wildlife not only saves animals, plants and beautiful natural spaces, but it also saves our future. We save ourselves when we save wildlife.

Amphibians	Mammals	Conifers	Birds	Sharks & Rays	Reef corals	Selected crustaceans
41%	26%	34%	14%	30%	33%	28%

Red List Category (flora & fauna)

- Extinct (EX) - 882
- Extinct in the Wild (EW) - 77
- Critically Endangered (CR) - 6811
- Endangered (EN) - 11732
- Vulnerable (VU) - 13898
- Near Threatened (NT) - 7211
- Least Concern (LC) - 62033
- Data Deficient (DD) - 17539

Why should we conserve wildlife?

- Protects ecological stability and balance
- Promotes pollination and continuity of native plant species
- Conservation of biological diversity
- Protects the livelihoods and knowledge of indigenous people
- Promotes tourism attraction
- Useful for conducting investigatory research
- Enhances food security
- Preserves heritage and culture
- Provides benefits for health and wellbeing
- Aesthetic and recreational value

How an individual can contribute to protect wildlife?

- Plant native species
- Adopt an animal
- Take part in conservation activities
- Promote Afforestation
- Restore habitats
- Avoid insecticides and chemical fertilizers
- Recycle and reuse
- Use eco-friendly products
- Resort to renewable energy
- Stop institutions selling of wildlife and wildlife trade



Green Deepavali Awareness by IFGTB ENVIS

IFGTB ENVIS organized an awareness campaign on 13.11.2020 to disperse the message on celebration of Green Deepavali following mandatory protocol to contain the spread of COVID-19.

Green Greetings on Green Deepavali Celebrations containing information on its need and the tips for celebrating the festival in a green way was released during the occasion and was electronically disseminated to students, public and all stakeholders.



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Diwali is a festival of lights, not of pollution and plights

Tips to celebrate green diwali

- Use traditional lighting
- Plant more trees
- Select eco-friendly gifts and decorating items
- Burst green crackers if inevitable
- Use eco-friendly colours for rangoli
- Avoid the use of plastics
- Discard waste responsibly
- Encourage recycling

IFGTB ENVIS wishes you a green and clean Diwali!

HAPPY DIWALI 2020



Digital Observance of World Soil Day 2020 by IFGTB ENVIS

IFGTB ENVIS marked the World Soil Day 2020 digitally. An awareness event on the theme “Keep Soil Alive, Protect Soil Biodiversity” prescribed by the FAO of the United Nations was organized through Facebook live in order to contain the spread of COVID 19. The digital observance also found a place in the worldwide events organized by the United Nations.

An Awareness Quiz on soil was also organized for students and general public. People from all walks of life have participated and E Certificate was also awarded to all. An awareness poster highlighting the importance of soil biodiversity was released during the occasion and its digital copies were shared with students and all the stakeholders. The online event can be accessed at <https://bit.ly/2JJ2umX>.

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WORLD SOIL DAY 2020

Keep Soil Alive, Protect Soil Biodiversity

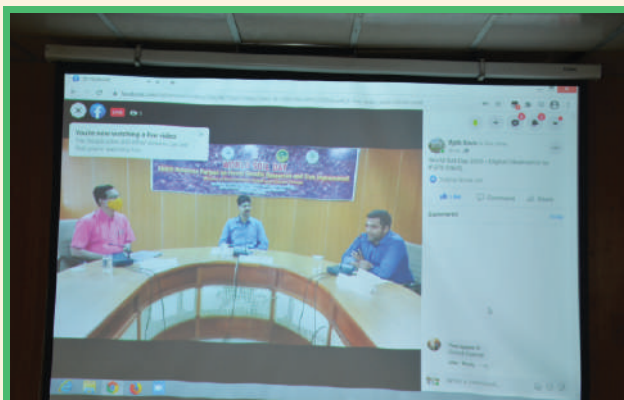
Plants nurture a whole world of creatures in the soil that in return feed and protect the plants. This diverse community of living organisms keeps the soil healthy and fertile. This vast world constitutes soil biodiversity and determines the main biogeochemical processes that make life possible on Earth. Soil biodiversity (including organisms such as bacteria, fungi, protozoa, insects, worms, other invertebrates, and mammals) enhances the metabolic capacity of soils and plays a crucial role in soil health and ecosystem functioning. Soils are a key reservoir of global biodiversity which ranges from microorganisms to flora and fauna.

Did you know?

- Soil organisms work 365/24/7 in a coordinated effort to sustain life on Earth.
- It is estimated that 1 to 6 billion ha (up to 30%) of land has been degraded globally.
- Healthy soils produce more nutritious and safer food. 95% of our food comes from soil.
- Only 1% of soil microorganism species are currently known compared to 80% of plant species.
- 25% of terrestrial biodiversity, soil organisms support life above ground.
- Up to 90% of living organisms live or spend part of their lifecycle in soil.
- Soil organisms can break down certain contaminants.
- Soil organisms process 25,000 kg of organic matter in a surface area equivalent to a soccer field.
- Land without vegetation can be eroded more than 100 times faster than land covered by vegetation.
- Soil without earthworms are 90% less effective.
- Earthworms enhance bioremediation, as they regulate the activity and distribution of microbes in the soil.
- One gram of soil can contain around 1 million individual fungi.
- Bacteria are thought to be the most species-rich group of organisms on Earth, and the vast majority of them live in the soil.

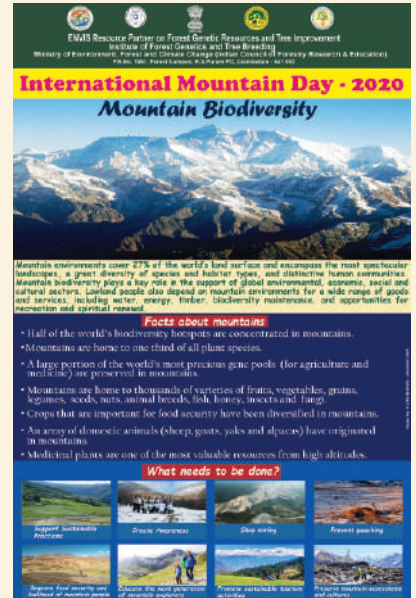
How to protect soil biodiversity

← Protect/increase biodiversity		→ Filter and degrade pollutants	
← Promotes soil fertility and yield			
← Prevent and reduce soil erosion			
← Support pollinators, natural predation of pest/pathogens			
← Protect and build carbon pools			
← Facilitates water infiltration and storage			
← Support plant growth and retain nutrients			



International Mountain Day 2020 Awareness Campaign by IFGTB ENVIS

IFGTB ENVIS organized an awareness campaign on the occasion of International Mountain Day on 11 December 2020. A tree sapling planting programme was also organized in the Forest Campus. Saplings of *Ficus racemosa* (Athi), *Terminalia bellirica* (Thanni), *Ficus benghalensis* (Banayan), *Hardwickia binata* (Acha Maram), *Pongamia pinnata* (Pungam), *Tectona grandis* (Teak) and *Dalbergia latifolia* (Rosewood) were planted by employees and students of the Institute. An online painting competition on the theme “Mountains and Biodiversity” was also conducted for students and the general public as part of the awareness campaign. Among the participants who took part in the competition from different parts of the world, Kum. Aisha Panda, Buxi Jagabandhu English Medium School, Odisha, Master A. Sachin, Gems, Our Own High School, Dubai and Master Aayush Kumar Jha, DAV Public School, Chennai won the first, second and third prizes respectively. Special prize was awarded to Ms V. Nivedhitha, Junior Project Fellow, IFGTB. Prizes were awarded to the winners and e-Certificates to all the participants.



An awareness poster on 'Mountain Biodiversity', the current year's theme identified by the United Nations was released and its digital copies were electronically disseminated to students, public and all stakeholders.



IFGTB PRODUCTS



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 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 , ACTO, 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		
	Tissue Culture Teak Plants	Rs. 25.00 per plant		
2.	Windbreak Clones (WBC-1, WBC-2, WBC-3 & WBC-4)	Rs. 4 per plant		Dr. C. Buvanewaran , Scientist- F, Silviculture & Forest Management Division, Phone : 0422 2484198, 94422 45047 E-mail : buvanesc@icfre.org
3.	ArborEasy® DNA Isolation Kit	Price Rs.	Packaging & Transportation Rs.	Dr. Modhumita Dasgupta , Scientist-F, Division of Plant Biotechnology, Phone : 0422 2484123 E-mail : ghoshm@icfre.org gmodhumita@gmail.com
	Pack Size			
	10 Reactions	950.00	150.00	
	20 Reactions	1900.00	200.00	
	50 Reactions	4750.00	300.00	
4.	Soil Testing (pH, EC, OC, Micro and Macro Nutrients)	Rs. 2850.00		Dr. A.C. Surya Prabha , Scientist-C, Silviculture & Forest Management Division, Phone : 0422 2484150 E-mail : acsuryaprabha@icfre.org
5.	Phytosanitary Certificate	Rs.100.00 + Tax per application		Dr. John Prasanth Jacob , Scientist- G, Forest Protection Division, Phone : 0422 2484159 E-mail : jacob@icfre.org
Products of IFGTB: For Sale & Booking				
6.	Hy-ACT (Natural and Seed Oil Based Biopesticide)	Rs. 80.00 per bottle		Dr. N. Senthilkumar , Scientist-E & Head, Division of Chemistry & Bioprospecting, Phone : 0422 2484193 Mobile : 9629160703 E-mail : senthink@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		(or)
	Tree Rich Biobooster (Instant Organic potting mixture for home garden, terrace and kitchen garden)	Rs. 50.00 per packet		Smt. R. Sumathi , ACTO Division of Chemistry & Bioprospecting, Phone : 0422 2484144 Mobile : 9942245542 E-mail : sumathir@icfre.org
	Tara Red Jam (with natural fruit colorant)	Rs. 60.00 per bottle		

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