



- Volume 7 Number 4
- A Quarterly Issue
- January - March 2021

ENVIS Newsletter Forest Genetic Resources & Tree Improvement

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



In this issue

1. Know Your Trees -
Tecomella undulata (Rohida)
2. ENVIS Activities



From the Director's Desk

The ENVIS Newsletter is an effort to spread information created through research on Forest Genetic Resources (FGR) and tree improvement by various research organizations. This enables the institute to update with latest knowledge on FGR, tree improvement and related aspects. This is a means of communication with stakeholders like SFDs, wood based industries, universities, farmers/ tree growers and NGOs. A good feedback system is also integrated by the ENVIS team.

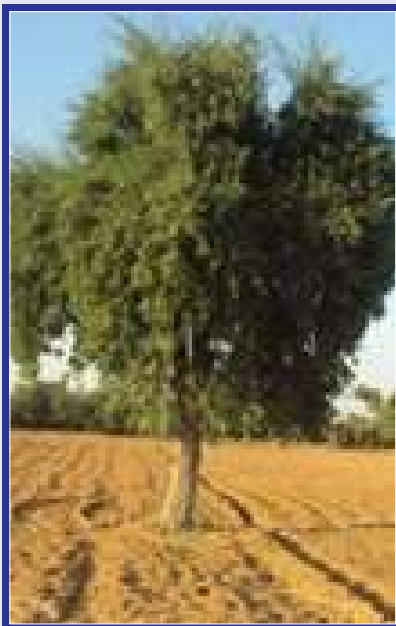
In this issue, under the "Know your tree" section, take you to the knowledge on important precious tree "*Tecomella undulata*" and other information on celebration different national/international days of importance. We welcome your suggestions and feedbacks and also seek your further support.

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Know Your Trees - *Tecomella undulata* (Rohida)

Introduction

Tecomella undulata (common name-Rohida), member of Bignoniaceae family is an important timber yielding tree species of arid and semi arid region. Rohida flower has the status of 'State flower' in Rajasthan due to its three colors attracting flowers (red, yellow and orange). It is also known as 'Marwar Teak' because of its quality timber which is comparable to Teak to a great extent. It is a very useful and key species for afforestation of the drier tracts due to its drought and fire resistant properties (Shankarnarayan and Nanda, 1963). The species also acts as a windbreak, soil binder and helps in stabilizing shifting sand dune thus playing an important role in ecology of this region. Along with this it has also occupied a reputed position of having valuable medicinal properties and has been mentioned in all



***Tecomella undulata* Tree**

ancient Samhita of Ayurveda. The species is also been used for the treatment of alleviating of syphilis, eczema, enlarged spleen, gonorrhea, leucoderma and liver disease (Saxena, 2000). The other part of the plants likes twigs and branches are used as fuel wood and the leaves and fruits are utilized as fodder. With the introduction of social and agroforestry programme under various projects for the upliftment of rural population, this species may become important capital earning species in arid and semi arid regions thus the farmers of these regions consciously maintain and promote *Tecomella undulata* (Rohida) along with other naturally growing trees in their fields with the aim to obtain fodder, fuel and timber.

Taxonomic classification

Kingdom	: Plantae
(Unranked)	: Angiosperms
(Unranked)	: Eudicots
(Unranked)	: Asterids
Order	: Lamiales
Family	: Bignoniaceae
Genus	: <i>Tecomella</i>
Species	: <i>T. undulata</i>

Distribution and habitat

Tecomella undulata (Sm.) Seem is an economically important plant species that originated in India and Arabia (Randhawa and Mukhopadhyay, 1986). Distribution of *Tecomella undulata* is restricted to the drier parts of the Arabia, southern Pakistan and

northwestern India up to an elevation of 1200 meters (Tewari 2007). In Pakistan it is found in the regions of Sindh and Baluchistan. In India, it occurs naturally in Maharashtra, Gujarat, Rajasthan, Punjab and Haryana. The species is mainly found to occur in western parts of Rajasthan. In other states its population is scanty and very rare. In Rajasthan, it is distributed throughout the districts of Barmer, Jaisalmer, Jodhpur, Pali, Ajmer, Nagaur, Bikaner, Churu and Sikar (Kritikar and Basu, 1993; Nandkarni 2000; Meena *et al.*, 2016).

This species is widely adapted to the arid regions (Khan *et al.*, 2003; Kar *et al.*, 2009) and occurs on flat as well as undulating areas including gentle hill slopes and sometimes also in the ravines. It can tolerate drained loamy to sandy loam soil having pH in the range of 6.5 to 8.0. The species thrives very well on stabilized sand dunes, which experience extreme low (0°C to -2°C) and high temperatures (48°C to 50°C). It grows in areas of scanty rainfall almost as less as 150 to 500mm annually. The tree is drought, frost, fire and wind hardy and also a strong light demander.

Botanical description

Tecomella undulata is a large shrub or tree with drooping branches and greyish-green leaves. Tree attains a height of about 7 to 14 m. The leaves are simple 5 to 12.5 cm in length and 1 to 3.2 cm in width, narrowly oblong, obtuse, and entire with undulating margins. Flowers are present in corymbose few flowered racemes, terminating short lateral branches, pedicels are 6 to 13 mm long, Calyx 9.5 to 11mm long,

campanulate and Corolla is 3.8 to 6.3 cm long, orange yellow, campanulate, veined. Lobes are 5 subequal and rounded. Stamens are exerted and filaments are glabrous. Stigma are 2 lamellate, lobes are spatulate-oblong, rounded. Lobes are 3mm long, broadly ovate, obtuse, mucronate. They are beautifully colored, odourless and found in yellow, red and orange colors. The tree blooms in the month of March-April and bears fruits, thereafter. Pods are slightly curved, linear-oblong, acute, smooth. Valves are thin. Seeds are creamish to light brown in color. Wings are very narrow round the apex of seed while absent at its base (Chal *et al.*, 2011).



Different flower color morphotypes of *Tecomella undulata*

Reproductive biology and breeding system

Tecomella undulata is near to evergreen tree species and defoliate completely for a very short period. Leaf-fall starts from beginning of November and carries up to March end. Three different flower colors are observed in *T. undulata* i.e. yellow, orange and red. Tree flowers from late November and continues up to the April end. In general, the duration of

flowering is more in yellow flowered trees than the trees with other colors. Peak flowering has been reported between February end to mid-March (i.e. 9 to 19 days). However, the total flowering duration varies from 59-103 days for the individual tree and 135 days for the whole population (Jindal *et al.*, 1985). Asynchronous type of flowering is observed in the species (Kumar *et al.*, 2017). Fruit formation starts in February and fruits are ready for harvest in the last week of March. Setting of fruit varies from 0.64% from selfing to 3.94% from cross pollination, indicating presence of self-incompatibility in the species (Jindal *et al.*, 1985). Studies of (Jindal *et al.*, 1985) and (Tripathi and Jaimini, 2002) indicated that only about 4-6% of flowers form fruits. The species has been reported as cross pollinated in behavior. Variable dark color flower in Rohida and nectar collected at the base of the flower inside the corolla attracts the birds or other insects for pollination (Jindal *et al.*, 1985). In *Tecomella undulata*, anthesis occurs between 6:00 am to 12:00 Noon and 5:00 am to 1.00 pm followed by dehiscence about an hour later (Tripathi and Jaimini, 2002) and (Kumar *et al.*, 2017). A wide range of pollen fertility has also been reported in this species, where pollen fertility ranges from 91.2% in orange flowers to 98% in yellow flowers (Kumar *et al.*, 2017). (Tripathi and Jaimini, 2002) recorded the pollen fertility as 96%, where the sub-spheroidal pollen measuring 78.14×69.9 showed maximum germination and pollen tube length observed in 10% sucrose solution supplemented with 0.005% boric acid. The stigma remains receptive

up to 24-30 of anthesis. The nectar robbing is also observed in Rohida which is the result of the ability of some floral foragers to steal nectar without effecting pollination Singh *et al.* 2014. The flowers are entomophilous and ornithophilous in nature and honeybees and Martin birds are the major pollinators in *T. undulata* (Jaimini and Tripathi 2002; Kumar *et al.*, 2017).

Fruit collection and processing

The ripening of pods starts at the month of mid February and are available for collection from March to April. Fruits harvested per tree vary from 11 to 143 and number of seeds per fruit varies from 58.7 to 135 seeds per fruit. Length and width of the pods varies significantly



Collection of Pods and Seeds of *Tecomella undulata*

from 18.6 to 26.2 cm and 9.0 to 10.7 mm (Meena *et al.*, 2016). The number of seeds varies from 70000 to 120000 to a kilogram and approximately 5000 plants can be expected from one kilogram of seeds (Sen Gupta 1937). One thousand seed weights ranges from 6.0 to 10.4 g. The seeds of this species varied greatly in their length and width ranging from 16.7 to 22.2 mm and 8.3 to 9.3 mm respectively (Meena *et al.*, 2016). Seed viability is greatest immediately postharvest and has reported to decline to zero after one year (Chakravarty and Chand, 1975).

Germination

Seeds do not require any pre sowing treatment and can be propagated by directly sowing the seeds in polythene bags containing the mixture of sand, soil and FYM, placed properly under the shaded mother beds. Studies carried out at AFRI, Jodhpur from the fresh seeds collected from the selected CPTs gave an average of 66% germination in nursery beds when grown in the month of May under 50% shade condition. Seeds sown vertically at a depth of 1.5 to 2.0 cm sprouted within two to three days. Freshly harvested seeds germinated well, hence seed dormancy was not observed during the study. Depending upon the source of collection, the seeds of the plant remain viable for about 12-18 months (Meena *et al.*, 2016).

Since, the species show three distinct morphotypes (Yellow, Orange and Red) therefore seed germination with respect to different flower colors was also recorded. Variation in seed germination with respect to different flower colors of the trees ranged from



Seed Germination at AFRI Nursery

73.22% (yellow flowered tree seeds) to 61.62 % (red flowered tree seeds). Orange colored flowers shown seed germination of 64.86%.

Vegetative propagation

Macropropagation studies were done to observe the effects of auxin (IBA), container type, potting mix, wax coating, differently managed tree, different thickness, season, genotype and different position of stem cutting in a tree canopy. In this IBA was not found suitable for rooting. Stem cuttings with 0.2 – 2.0 cm thickness were tried and best result was observed in the cuttings with 1.0 to 1.4 cm thickness. Late winter (January to March) was the best period for root initiation (15 %). Among the 4 different genotypes viz. Tree no. 9, 12, 17 and 21, highest sprouting (99 %), root primordial

formation (48.1 %) and rooting (10.4 %) was observed in tree no.9, which was significantly different from other three genotypes. (Tyagi *et al.*, 2011).

Data analysis resulted that upper portion of the branch collected from middle crown of the tree canopy rooted 33.3% maximally. Stem cuttings collected from this tree also produced flower buds and flowers in the mist-polyhouse itself (Tyagi *et al.*, 2011).

In vitro propagation

Micropropagation of *T. undulata* is still difficult particularly due to unpredictability of adventitious rooting. Therefore, there is a need for improvement in shoot multiplication and long-term sub culturing and for better knowledge of root induction in this species.

First report on standardization of *T. undulata* protocol was carried out Rathore *et al.* 1991 by using seedlings and mature trees as source of explants. Shoot induction from mature (25-year-old) and seedling explant was found best on Murashige and Skoog's (MS) medium supplemented with 0.05 mg/l IAA and 2.0 mg/l BA at 31°C after 2-3 weeks when kept at 43 $\mu\text{E m}^{-2} \text{s}^{-1}$ photon flux density and a 12-h/day photoperiod. Maximum 79 % of bud break was achieved in the month of August-September. The *in vitro* shoots were multiplied by sub culturing on fresh MS medium containing IAA (0.01 mg/l) and BA (1.0 mg/l) within 3 weeks at $26 \pm 2^\circ\text{C}$ and 36 $\mu\text{E m}^{-2} \text{s}^{-1}$ photon flux density. Isolated shoots were rooted by culturing on half strength MS liquid medium containing IBA (2.5

mg/l) for 48 h and then transferred to hormone-free half strength MS medium. About 60 % of *in vitro* produced shoots were rooted.

In continuation of this, many researchers attempted for regeneration of *Tecomella undulata* and succeeded to induce shoots from various explants from mature plants (Arya and Shekhawat, 1986 ; Bhansali 1993 ; Nandwani *et al.*, 1996 ; Kumari and Singh, 2012 ; Chajjer and Kalia, 2016). In 1993, Bhansali reported 30 % rooting on one-third strength modified woody plant basal medium supplemented with 0.3 mg/l indole butyric acid (IBA) or NAA.

By taking the seedlings derived explants like cotyledonary nodes on various medium for growth, many researchers were successful in developing regeneration protocol for *T. undulata* (Nandwani *et al.* 1992; Robinson *et al.* 2005; Aslam *et al.* 2006; Singh *et al.* 2009; Varshney and Anis, 2012).

In 2013, Tyagi and Tomar from AFRI, Jodhpur studied the rooting ability of mature trees of *T. undulata* through micropropagation. They refined its *in vitro* propagation using nodal segments from mature trees. Results shows that the *in vitro* shoot cultures can be established throughout the year but the most favorable months for bud break (75%) was January and February on Murashige and Skoog (MS) medium supplemented with 0.54 μM NAA and 8.8 mg IBA. Correlation studies on different classes of shoot length and rooting revealed that the rooting percentage increases with the increase in shoot length and shoots less than 2.5 cm long does not root at all. The rooted plantlets were

successfully hardened followed by flowering which was recorded in tissue culture plants for two consecutive years.

Insect pests and diseases

It was evident that seedling and young plantations of *Tecomella undulata* were severely attacked by a defoliator Curculionid pest *Patialus Tecomella*, throughout the tract of its distribution in arid and semi arid areas. Larvae feed in mass on leaves and causes skeletonization of the leaves of *Tecomella*. Apart from the severe infestation caused by *Patialus Tecomella*, several other insect species (grouped as defoliators, sap-sucking insects, stem and root borers, dry wood borers, seed pests, leaf miners, nursery pests and termites) have been recorded either to cause mild to moderate damages or just associated as casual visitors to the flowers, fruits and foliages of *Tecomella undulata*. In all 64 insect species belonging to six order and 32 families have been recorded in the form of pests to young and established plantations of *Tecomella undulata* in different stages of its development (Sharma and Ahmed, 2006; Sharma 2016).



Infestation at nursery stage

Apart from the above pests, two other species of imperfect fungi viz. *Phoma sp.* and *Botryodiplodia theobromae* were also found which are primarily responsible for canker-rots and subsequently attract borers and heart rot pathogen (*Fomes sp.*). The infection occurs in the form of splitting of bark on the bole, which spreads in upward and downward direction (Singh 2015).

Planting techniques and post planting operation

Nursery raised hardened plants are shifted to fields for plantation in the month of July-August. Pits of 60X60X60 cm are to be prepared at an optimum spacing of 4m between row to row and 3 m between plant to plant and filled with FYM. NPK in the ratio of 750: 600:300 gm/plant is given as single basal dose. One to two harrowing is to be given in the middle space for keeping the field clean. Irrigation may be given as per the season during winter at 30-40 days interval and summer at 20-30 days interval during first year. Subsequently, trial was irrigated three times for next subsequent two years. After establishment of the plants, it is not necessary to give frequent irrigations. However, all silvicultural operations (weeding, cleaning) were carried out to maintain the trial in good shape. The plants need to be protected from termites and stem borer for which suitable insecticides are used.

Agroforestry practices

In 2009, Singh studied the tree crop interactions by measuring tree growth

characters of *Prosopis cineraria* and *Tecomella undulata* and yields of *Vigna radiata* in agroforestry systems in degraded lands of Indian deserts. Potential competition for resource between the trees and associated crop was analyzed by measuring soil water contents, soil organic matters and NH₄-N at different depths of soil layers i.e, 0-25cm, 25-50 cm and 50-75cm in the experimental plots. Results showed increase in tree height by 3% to 7%, collar diameter by 11% (D1), 19% (D2) and 36% (D3), crown diameter by 11 % to 16% during June 2002 to June 2004. Yield of *V. radiata* increased linearly from D1 to D3 Plots. The yield of agricultural crop increased when density of tree species was appropriate (i.e., optimum tree density), though it varied with tree size and depended upon resource availability.

Tree improvement

Tree improvement studies for *Tecomella undulata* is sparse. Arid Forest Research Institute, Jodhpur are working on tree improvement of Rohida. 86 Candidate Plus Tree were identified from Barmer, Jaisalmer, Bikaner, Nagaur, Sikar, Churu, Jalore, Pali and Jodhpur district of Rajasthan and established half sib progeny trials at Jodhpur, Bikaner and Jhunjhunu district of Rajasthan. The 11-year-old trial existing at Jodhpur performed well compared to Bikaner trial with 87% of survival at Jodhpur and 58% at Bikaner. Average height of plants at Jodhpur was 236 cm and at Bikaner it was 128 cm. Similarly, an average collar diameter of plants at Jodhpur was 4.45cm whereas at Bikaner was 1.92 cm respectively.

The progeny of CPT-37 (Jodhpur) gave the best growth at Jodhpur attaining the height of 276 cm with collar diameter of 6.6 cm whereas the progeny of CPT-27 (Barmer) gave best growth at Bikaner with height of 156 cm and collar diameter of 2.6 cm. Similarly, growth data were also recorded for the trials established in 2013 and 2014 which showed an average height of 122 cm and collar diameter of 1.71 cm at Jodhpur and height of 42.53 cm and collar diameter of 0.48 cm at Jhunjhunu. The progeny of CPT No-36 from Pali (Ht 180 cm, Girth 3.2 cm) performed best at Jodhpur site whereas the CPT No-25 from Churu attaining the height of 75.5 cm and Girth of 0.78 cm performed best at Jhunjhunu district.



Identified Candidate plus trees of Rohida



Half sib Progeny trial of Rohida at Jodhp

Utilization

Tecomella undulata is an important timber yielding tree species which has various medicinal as well as ecological applications. Bark of the tree contains alkanes, heart wood contains iridoid glycosides 6-o-veratroyl catalposide and tecomelloside and flowers contain flavonoids which are of medicinally important. Wood obtained from the tree is soft, durable strong and resilient. The color of the wood varies from grayish to yellowish brown and the specific gravity is found to be of 0.57 to 0.83. Timber of this species is classified as heavy, moderately strong, not tough, very stable, moderately hard and recommended for furniture, doors, window shutters, frames, tool handles, agricultural implements, pallets, handicrafts and preparation of carom draughts. Three different flower colors are observed in *T. undulata* i.e. yellow, orange and red. The preliminary data of the study carried out by AFRI, Jodhpur, for various mechanical and physical properties of wood among three different color morphotypes reveals that red flower color trees was found to be more for Sp



Felling of trees and preparation of samples for wood property studies

gravity, Fibre stress at elastic limit, Modulus of Rupture, Modulus of Elasticity, Hardness and Shear Strength Parallel to grain in comparison to other flower color trees.

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ENVIS ACTIVITIES

A Green Skill Development Programmes

Forest Entomology and Pest Control

A Green Skill Development Programme (GSDP) on “**Forest Entomology and Pest Control**” (level-6) was conducted by the ENVIS Resource Partner on Forest Genetic Resources and Tree Improvement at the Institute of Forest Genetics and Tree Breeding (IFGTB), Coimbatore from 22.02.2021 to 26.03.2021. The training module included theory, field visits, field exercises and assignments.

The training programme (NSQF level 6) was for a period of 27 working days (216 hours). Field trips to various insectariums, entomology labs, sericulture units, bee parks, farmers' fields etc were arranged for the participants to provide a real time exposure on entomology. The participants were trained on various aspects of forest pathology, forest entomology and management of pests and pathogens species infesting tree species, insect field biology, principles of management of social insect's etc. 15 trainees from various part of the country successfully completed the course.



Plant Tissue Culture Techniques & its Applications

A Green Skill Development Programme (GSDP) on “**Plant Tissue Culture Techniques and its Applications**” (level-6) was conducted by the ENVIS Resource Partner on Forest Genetic Resources



and Tree Improvement at the Institute of Forest Genetics and Tree Breeding (IFGTB), Coimbatore from 22.02.2021 to 26.03.2021.

The training programme (NSQF level 6) was for a period of 40 working days (320 hours) and the training module included theory (35%) and practical (65%). Field trips to various commercial tissue culture labs, bio-fertilizer production units, nurseries etc were arranged for the participants to provide a real time exposure on tissue culture. The participants were trained on various aspects of tissue culture which includes selection of explants, media preparation, sterilisation, culture initiation and maintenance, rooting, hardening; acclimatisation etc. 14 trainees from various part of the country successfully completed the course.

Quality Planting Material Producer

A Green Skill Development Programme (GSDP) on “**Quality Planting Material Producer**” (level-4) was conducted by the ENVIS Resource Partner on Forest Genetic Resources and Tree Improvement at the Institute of Forest Genetics and Tree Breeding (IFGTB), Coimbatore from 22.02.2021 to 26.03.2021. The training module included theory, field visits, field exercises and assignments.

The training programme (NSQF level 4) was for a period of 30 working days (240 hours). The participants were trained on various aspects of seed technology, nursery management, production of nursery, management of clonal nurseries, methods of vegetative propagation, preparation of rooting media, plant growth promoting substances and their applications, bio-control agents, pest & disease management, bio-fertilizer production and production of quality planting stock on a large scale. Field trips to a commercial clonal nursery, bio-fertilizer production unit, Forest College and Research Institute, Mettupalayam, Horticulture Directorate and Tamil Nadu Newsprint & Papers Ltd., Karur were arranged for the participants to provide a real time exposure on quality planting material production. Nineteen participants from various part of the country successfully completed the course.



Digital Observance of World Wetlands Day 2021 by IFGTB ENVIS

The ENVIS Resource Partner on Forest Genetic Resources and Tree Improvement at the Institute of Forest Genetics and Tree Breeding, Coimbatore marked World Wetlands Day 2021, the 50th Anniversary of the Ramsar Convention digitally on 02.02.2021 by organizing an awareness event through Facebook live in order to contain the spread of COVID 19. A mobile photography contest was also conducted for students and public on the topic “Wetlands and their Significance”. Both the events were registered in the worldwide events organized by World Wetlands Authority.

The digital event began with Prakruthi Vandanam, an invocation on nature in Sanskrit based on Yajur Veda by Dr Kannan CS Warriar, Scientist F and ENVIS Coordinator. Dr C Kunhikannan, Director, IFGTB in his special address pointed out that wetlands are rich with biodiversity and are habitats for a dense variety of plant and animal species. Through the ability to absorb nutrients, wetlands are able to produce biomass quickly. Their ability to efficiently create biomass may become important to the development of alternative energy sources. However, unsustainable use of wetlands without reckoning of their assimilative capacity constitutes a major threat to the conservation and management of these vital biodiversity rich areas. Results of the Mobile Photography Contest held on the theme “Wetlands and their Significance” were declared by the Chief Jury, Dr John Prasanth Jacob, Scientist G. Among the 79 participants who took part in the contest from different states of India, Ms B. Divyadharshini, 2nd Grade, Chinmaya Vidyalaya, Kilpauk, Chennai, Shri Suraj Pratap Singh, Centre of Environmental Studies, Department of Botany, University of Allahabad, Uttar Pradesh and Shri Jayeshkumar Vaghela, Wildlife Trust of India, Gujarat won the first, second and third prizes respectively. Prizes were awarded to the winners and E Certificates to all the participants. An awareness poster and a video highlighting the importance of conservation of wetlands were released during the occasion and its digital copies were shared with students and all the stakeholders. Dr S. Vigneswaran, Programme Officer, ENVIS proposed the vote of thanks. The online event can be accessed at <https://bit.ly/39GwOZO>. The awareness video can be accessed at <https://bit.ly/3au40TT>.



International Day of Forests Observance by IFGTB ENVIS

The ENVIS Resource Partner on Forest Genetic Resources and Tree Improvement at the Institute of Forest Genetics and Tree Breeding, Coimbatore (IFGTB ENVIS) observed the International Day of Forests (IDF) on 21st March 2021. A mass tree sapling planting programme was organized at Panampally Field Research Station of IFGTB near Palakkad. Dr Kannan CS Warriar, Scientist F and ENVIS Coordinator during his welcome speech and introductory remarks, elaborated on the importance of observing International Day of Forests and highlighted on vernal and autumnal equinoxes. Dr Warriar also recited an awareness song on forests, 'Kadarivu', the official theme song of Kerala Forests and Wildlife Department, music composed by himself and penned by Shri Pramod Krishnan, Chief Conservator of Forests. IFGTB Director Dr C Kunhikannan inaugurated the programme and spoke in detail on the significance of restoring degraded forest ecosystems. The Director also spoke on the species recovery research programmes undertaken by the Institute. Dr Rekha R Warriar, Scientist F explained the significance of establishment of a DUS (Distinctiveness, Uniformity and Stability) centre on an indigenous tree species *Melia dubia* (Malaivembu) which will serve as a reference collection for future use and helpful for the tree growers and farmers in registering their varieties with the Protection of Plant Varieties and Farmer's Rights Authority. A poster highlighting the theme of IDF 2021, "Forest Restoration: A path to recovery and wellbeing" was released during the occasion and its digital copies were shared with students and all the stakeholders. Students and participants of the three Green Skill Development Programmes being organized by IFGTB ENVIS planted over 300 saplings in Panampally Field Research Station. An essay competition on the topic "Ways of improving native flora" at the all-India level was also organized as part of the event and E certificates were distributed to all the participants. Dr S Vigneswaran, Programme Officer ENVIS proposed the vote of thanks.



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