ISSN : 2394-7543

ENVIS Newsletter
Forest Genetic Resources & Tree Improvement

VAN VIGYAN

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

- Volume 1 Number 2
- A Quarterly Issue
- March 2015

From the Director's Desk

The Institute of Forest Genetics and Tree Breeding (IFGTB), a national Institute under ICFRE, with a pan India mandate to carry out tree improvement has been focusing on developing new varieties of both exotic and indigenous tree species. Systematic tree improvement programmes in various stages namely first generation, second and third generation are in place. Parallely the Institute also addresses conservation issues like restoration of degraded lands, reclamation of problem soils, understanding population dynamics of species etc.

The Institute also reaches out to the stakeholders through capacity building programmes. Seven training programmes were conducted on different aspects like awareness on biodiversity act, taxonomy, bamboos, medicinal plants and production of biofertilisers.

IFGTB deems it an honour to have hosted the 2-day evaluation-cum-training Workshop for ENVIS Centres of Southern Region on 5th and 6th February, 2015. The Economic Adviser, Shri. M. Kannan, experts, Dr Rajasenan, Dr Rajaannan, Dr G. Srinivas Rao, Dr Hariprlya Gundimeda and Prof. Kavikumar evaluated the centres. The Institute staff along with the ENVIS centre, participants from various states were immensely benefitted by the training on Bhuvan portal, imparted by NRSC officials Dr P. G. Diwakar and Shri. Arul Raj.

In this issue of the quarterly newsletter under ENVIS, we would like to familiarise the readers with latest happenings on Forest Genetic Resources. The issue carrys details on Rosewood under 'Know your trees' series. We also hope to bring out information related to FGRs and Tree improvement in the form of articles, reports and documents. The ENVIS team sincerely looks forward to your suggestions and feedbacks and seeks your support and co-operation.

R.S. Prashanth
Director

In this issue

FGRs - What next

The Global Plan of Action for the Conservation, Sustainable Use and Development of Forest Genetic Resources, based on the findings of The State of World's Forest Genetic Resources (SoW-FGR, 2014), was adopted by the FAO Conference at its 38th session in June 2013. The Global Plan of Action was informed by the 86 Country Reports and the results of the Regional Synthesis Workshops. The Commission of Forestry, the highest FAO Forestry statutory body, recommended the implementation of the Global Plan of Action on FGR in its 22th session in June 2014. The Global Plan of Action has 27 Strategic Priorities, grouped into four areas: (1) improving the availability of, and access to, information on FGR, (2) conservation of FGR *(in situ* and *ex situ)*, (3) sustainable use, development and management of FGR, and (4) policies, institutions and capacity building. The Strategic Priorities for Action constitute a comprehensive global programme of work. They can assist countries in integrating FGR conservation and management needs into wider policies, programmes and frameworks of action from local to national, regional and global levels, and in developing sound technical and scientific programmes for the successful management of FGR. Implementation of the Global Plan of Action will strengthen the sustainability of FGR while contributing towards the Aichi Biodiversity Targets and the Sustainable Development Goals. The Commission on Genetic Resources for Food and Agriculture, in its 14th session, requested FAO to develop an implementation strategy for the Global Plan of Action on FGR, and encouraged the mobilization of adequate financial resources, preferably from voluntary contributions, particularly to support developing countries in the implementation of the Global Plan of Action.

The Regional Planning Workshop to Support The Implementation of The Global Plan of Action for Forest Genetic Resources was held in Kuala Lumpur, Malaysia from 17 - 19 September 2015. The workshop was attended by 11 National Coordinators and Focal Points of The Asia Pacific Forest Genetic Resources Program (APFORGEN).

APFORGEN established three Working Groups to support the implementation of the Global Plan of Action on Forest Genetic Resources (GPA FGR) in the Asia Pacific region.

Working Group 1: Mobilizing Political and Financial Support for the Implementation of the Global Plan of Action for Forest Genetic Resources in the Asia Pacific Region.http://www.apforgen.org/FGR2014/APFORGEN WG1 - Mobilizing support.pdf

Working Group 2: Conservation and Sustainable Use Strategies for Regionally Important and Endangered Tree Species.

http://www.apforgen.org/FGR2014/APFORGEN WG2 - Species conservation.pdf

Working Group 3: Strengthening Tree Seed Programmes to Facilitate Ecosystem Restoration, Support Local Livelihoods and Climate Change Adaptation and Mitigation. http://www.apforgen.org/FGR2014/APFORGEN WG3 Seed programmes.pdf

India is a member of WG 3 with the following targets

- Strengthen demand-driven tree seed programmes for ecosystem restoration, plantation and agroforestry
- Strengthen multi-purpose tree breeding programmes in support of provision of ecosystem services, climate change adaptation and livelihoods
- Policy-level support in institutionalizing tree seed supply systems
- The activities of this Working Group contribute, in particular, to the following Strategic Priorities of the Global Plan of Action on FGR:
- Develop and reinforce national seed programmes to ensure the availability of genetically appropriate tree seeds in the quantities and of the (certified) quality needed for national plantation programmes (Strategic Priority 12)
- Promote restoration and rehabilitation of ecosystems using genetically appropriate material (Strategic Priority 13)
- Develop and reinforce research programmes on tree breeding, domestication and bioprospection in order to unlock the full potential of FGR (Strategic Priority 16)
- Promote the participation of indigenous and local communities in FGR management in the context of decentralization (Strategic Priority 22)

ASIA PACIFIC FOREST GENETIC RESOURCES PROGRAMME (APFORGEN)

APFORGEN is an established regional programme and network with a holistic approach to the conservation and management of forest genetic resources (FGR) in Asia and the Pacific. It was formed in 2003 through the initiative of Biodiversity International and Asia Pacific Association of Forestry Research Institutions (APAFRI). APAFRI acts as the secretariat of the network with headquarter at Selangor, Malaysia. It receives a modest source of funding from Biodiversity International. The International Union of Forestry Research Organizations (IUFRO) has endorsed APAFRI as its Asia Pacific chapter. APAFRI has been collaborating closely with the IUFRO Special Programme for Developing Countries (SPDC) in strengthening research in the Asia Pacific region.

Fourteen countries in Asia and the Pacific including Bangladesh, Cambodia, China, India, Indonesia, Lao PDR, Malaysia, Myanmar, Nepal, Pakistan, Philippines, Sri Lanka, Thailand and Vietnam are members of the network. The broad objective of APFORGEN is to promote the management of tropical forest genetic resources more equitably, productively and sustainably in the member countries. Its aim is to enhance technical, scientific cooperation, training and information exchange among the member countries, through linking and providing technical support to national forest programmes, research institutions, NGOs and individuals interested in the conservation and management of forest genetic diversity in the region.

Since the inception workshop held in Kuala Lumpur, Malaysia 2003, the member countries have been actively participating in the network activities through providing country status updates, participating in workshops, meetings, training courses, symposium and planning of joint activities through email consultation. From then, the programme has held several successful meetings represented by National Co-ordinators of each participating countries. The main focus of such meetings is to strengthen national capacity and regional collaboration for sustainable use of FGR in the regions. Also APFORGEN has conducted two consultative workshops, training courses for field staff and one International Symposium on FGR.

It is a known fact that Asia harbours the highest number of tree species and subspecies among the world's continents. Recently, in recognition of the unique ecological and socio-economic value of the region's FGR and the urgency to conserve them, APFORGEN has developed and agreed on a Strategy for Regional Collaboration to support the implementation of the Global Plan of Action for the Conservation, Sustainable Use and Development of Forest Genetic Resources.

Recent literature on FGRs and TIP

1. Arruda, C.C.B., Silva, M.B., Sebbenn, A.M., Kanashiro, M. Lemes, M.R. and Gribel, R. 2015. Mating system and genetic diversity of progenies before and after logging: a case study of *Bagassa guianensis* (Moraceae), a low-density dioecious tree of the Amazonian forest. Tree Genetics and Genomes 11:3 DOI 10.1007/s11295-015-0837-2
2. Bednorz, L., Myczko, L. and Kosiński, P. 2015. An assessment of genetic diversity following natural regeneration of *Sorbus torminalis* in the Forest District of Jamy (northern Poland). Dendrobiology 73: 111-1116.
3. Coulston, J.W., Wear, D.N. and Vose, J.M. 2015. Complex forest dynamics indicate potential for slowing carbon accumulation in the southeastern United States. Nature Scientific Reports 5 : 8002 | DOI: 10.1038/srep08002
4. Evans, L.M., Slavov, G.T., Rodgers-Melnick, E., Martin, J., Ranjan, R., Muchero, W., Brunner, A.M., Schackwitz, W., Gunter, L., Chen, J., Tuskan, G.A. and DiFazio, S.P. 2015. Population genomics of *Populus trichocarpa* identifies signatures of selection and adaptive trait associations. Nature Genetics 46(10): 1089-1096.
5. Ghazalli, M.N., Yunus, M.F. and Mohammad, A.L. 2015. Assessment of genetic relationships within *Bouea* (Anacardiaceae) accessions in Peninsular Malaysia using inter simple sequence repeats (ISSR) markers. African Journal of Biotechnology 14(2): 76-85.
6. Júnior, A.F.M., Carvalho, D., Brandão, M.M., Sousa, L.G., Vieira, F.A., Menezes, E.V., Royo, V.A. and Oliveira, D.A. 2015. Spatial genetic structure of *Cavanillesia arborea* K. Schum. (Malvaceae) in seasonally dry Tropical forest: Implications for conservation. Biochemical Systematics and Ecology 58: 114-119.
7. Kajba, D. and Andrić, I. 2015. Forest Reproductive Material and Conservation of Forest Genetic Resources in Croatia. Open Journal of Forestry 5: 117-128.
8. Lumibao, C.Y., Gaskill, M., Flood, K. and McLachlan, J.S. 2015. Persistence of genetic variation in recolonized *Tsuga canadensis* (Eastern hemlock) populations following historic forest clearance. Plant Species Biology doi: 10.1111/1442-1984.12079
9. Singh, R.K., Singh, A., Garnett, S.T., Zander, K.K., Lobsang, and Tsering, D. 2015. Paisang *(Quercus griffithii)*: A Keystone Tree Species in Sustainable Agroecosystem Management and Livelihoods in Arunachal Pradesh, India. Environmental Management 55: 187-204.
10. Sjölund, M.J. and Jump, A.S. 2015. Coppice management of forests impacts spatial genetic structure but not diversity in European beech *(Fagus sylvatica L.)*. Forest Ecology and Management 336: 65-71.
11. Tiwari, C. and Bakshi, M. 2015. Isozymatic characterization of Accessions of *Arundinaria falcata* (Nees). Forest Research 4: 133. doi: 10.4172/2168-9776.1000133
12. Varghese, A., Ticktin, T., Mandle, L. and Nath, S. 2015. Assessing the Effects of Multiple Stressors on the Recruitment of Fruit Harvested Trees in a Tropical Dry Forest, Western Ghats, India. PLOSONE DOI:10.1371/journal.pone.0119634
13. Villalobos-Barrantes, H.M., García, E.G., Lowe, A.J. and Albertazzi, F.J. 2015. Genetic analysis of the dry forest timber tree *Sideroxylon capiri* in Costa Rica using AFLP. Plant Systematics and Evolution 301: 15-23.
14. Wattanakulpakin, T., Iamtharn, S., Grubbs, K.C. and Volkaert, H.A. 2015. Population genetic analysis of *Xylia xylocarpa* (Fabaceae-Mimosoideae) in Thailand. Tree Genetics and Genomes 11:7DOI10.1007/s11295-014-0825-y
15. Zarpelon, T.G., Guimarães, L.M.S., Faria, D.A., Coutinho, M.M., Neto, B.C., Teixeira, R.U., Grattapaglia, D. and Alfens, A.C. 2015. Genetic mapping and validation of QTLs associated with resistance to Calonectria leaf blight caused by *Calonectria pteridis* in Eucalyptus. Tree Genetics and Genomes 11: 803-811

Know your trees - Rosewood

Dalbergia latifolia Roxb.

Family: Fabaceae

It is known under the trade names "Indian Rosewood" or "Bombay black wood". *D. latifolia* is naturally distributed in the Indo-Malaysian region. In India, it occurs in the sub-Himalayan tract from Oudh eastwards to Sikkim, Bihar, Orissa, Central, Western and Southern India. *D. latifolia* is found in the dry and moist deciduous forests of the country, up to an altitude of 1200 m. The important associates of *D. latifolia* are *Bombax ceiba, Xylia xylocarpa, Tectona grandis, Terminalia* spp., *Pterocarpus marsupium, Anogeissus latifolia, Holoptelia integrifolia, Lagerstroemia lanceolata, Wrightia tinctoria, Grewia tiliifolia, Cassia fistula, Macaranga peltata* and Bamboos. It is considered as one of the most precious timbers in India.

D. latifolia was introduced to some countries in Asia, including Sri Lanka, where there are a few trees under natural conditions. Plantations were started in 1873 in Java. The species has also been introduced to African countries, including Nigeria, Tanzania and Kenya (Agroforestry Tree Database, 2009).

Natural regeneration of *D.latifolia* on rocky stream bed, Bargur , Erode

Photo Credit
K.R.Sasidharan, IFGTB, Coimbatore

Seed Collection, Processing and Nursery Techniques

D. latifolia - young pod

Photo Credit
K. Muraleekrishnan, IFGTB, Coimbatore

Ripe fruits are available from October to April depending on the locality. The fruits remain on the trees until the onset of the rainy season. When the pods have turned dark brown they are collected from the trees by lopping the branches. After collection, the pods are dried in sun light and broken into segments each containing one seed. It is not necessary to extract the seeds. The pods can be rubbed with a soft material like leather or rubber to release the seeds (Joker, 2004). The seeds are stored in gunny sacks or earthen pots. The seed remains viable for six months (Kadambi, 1954). The seeds lose their viability appreciably when kept for more than one year. Seed viability can be extended to 9-12 months by drying the seeds to 8 per cent moisture content and storing them in airtight containers, however, germination will decrease to 30-40 percent. Studies in India reveal considerable variation in seed weight (18,500 to 40,000 seeds per kilogram).

Soaking seed in cool water for 12-24 hours is found to hasten the germination. The seeds are sown in March or April, in raised nursery beds, preferably of sandy loam. The beds are regularly watered and weeded. The bed has to be protected from hot sun. Germination takes 7 to 25 days and the germination varies from 45 to 80 per cent for fresh seeds.

Phenology, Reproductive Biology and Breeding System

Common crow butterfly (*Euploea core*) pollinating *D. latifolia* flowers

Indian honeybee (*Apis cerana indica*) pollinating *D. latifolia* flowers

Photo Credit: K. Muraleekrishnan, IFGTB, Coimbatore

In drier natural habitats, *D. latifolia* sometimes sheds leaves (either partially or sometimes fully) by the end of January and fresh foliage appears in April-May. In moist conditions, the trees remain evergreen throughout the year. (Agroforestry Tree Database, 2009). Flowering begins by November and normally continues to March or rarely to October. *D. latifolia* is an obligate out-crosser. The fruit setting obtained through open pollination was 5.24 percent and through cross-pollination (xenogamy) experiments, the fruiting obtained was 4 percent. Even though 2 percent fruit setting through self pollination (autogamy) was observed, the fruits produced fell off prematurely (Table-1). Pollination mode is mainly entomophily, through bees and butterflies, though a few nectar feeding birds also visit the flowers. The Indian honeybee *(Apis cerana indica)* was found to be the major pollinator of D.latifolia. They moved frequently from flower to flower on different trees for collection of nectar and pollen, thus effecting cross-pollination. A few butterflies like Common lineblue *(Prosotas nora)*, Common sailer *(Neptis hylas)*, Common crow butterfly *(Euploea core)* and Danaid eggfly *(Hypolimnas misippus)* as well as the Sunbird *(Nectarinia minima)* visited the flowers for nectar feeding (Table -2). The seed dispersal mode is through wind.

Table 1 - Breeding behaviour in *Dalbergia latifolia**

Treatments	No. of flowers pollinated/ observed	No. of flowers set fruit	% of fruit set
Autogamy	50	1	2
Geitonogamy	50	0	0
Xenogamy	50	2	4
Apomixis	50	0	0
Open pollination	916	48	5.24

*Observations made on 25 Trees

SILVICULTURE

Caterpillar of Slate flash (*Rapala manea*) – a flower pest of *D. latifolia*

Photo Credit: K. Muraleekrishnan, IFGTB, Coimbatore

Under natural conditions, *D. latifolia* reproduces by seed, root sucker or coppice. Forest Working Plans prescribe either coppicing or some form of selection felling. Artificial regeneration is recorded for supplementary natural production, if the latter is inadequate. The seedlings are directly transplanted or made as stumps and planted in June after getting the first rain. *D. latifolia* can be quickly established by stump sprouts. Stumps are made from seedlings of seed or cutting origin. Stump roots and shoots should be 4.5 cm and 2.5-4.0 cm long, respectively. Root-collar diameter should be 0.5-1.5 cm (Deshmukh, 1975). Planting must coincide with heavy rains or the survival will be low.

Apart from the tap root and lateral roots, a kind of special propagation roots with buds, which do not go down but spread radially outwards and run horizontally not far below the surface of the ground or sometimes even at the surface, are formed early in the life of the tree. Such roots produce numerous root suckers and send them up to the ground surface, particularly where the roots are exposed or wounded. Many of these suckers develop into trees. Hence it is not unusual to see old trees surrounded by large numbers of younger trees developed from suckers. These suckers are most plentiful in situations exposed to light, for example on edge of roads, fire-lines and boundary lines (Tewari, 1995).

For propagation by root suckers, the root cuttings should be taken from trees that are at least 5 years old. Recommended length of cuttings is 20 cm with a diameter of 1-2 cm. The cuttings are kept at room temperature for three days before planting them in either nursery beds or polyethylene bags (Soekeri, 1979). The length of the cutting to be planted below soil surface is 18cm with 2cm above the ground. The cuttings are to be transplanted to the field after 6 months in the nursery (DMI, 1980).

Stump planting is the best method for raising the species, though direct sowing and planting out entire seedlings are also successful. Comparison experiments with (1) direct sowing, (2) planting out entire seedlings and (3) stump planting carried out in Tamil Nadu, from 1933 to 1938 showed that stump planting yields significantly best results both in terms of survival percent and height growth (Tewari, 1995).

As pure stands, *D. latifolia* is spaced at 1.2 x 1.2 to 1.8 x 1.8 m (Deshmukh, 1975) or 2 x 1 to 2.5 x 1 m (Kadambi, 1954). The experiments conducted at Dehra Dun have shown that the species can be grown under irrigation (Troup, 1921; Cameron, 1894). Wider spacing may produce crooked stems. Trees are usually harvested in 30-40 years. *D. latifolia* is generally managed by clear felling followed by artificial regeneration. After planting or direct sowing, regular weeding is necessary until trees can withstand weed competition. Loosening soil around seedlings also improves growth. When young, the tree can tolerate good shade and when it grows in too open areas, it becomes crooked and branchy.

More than 40 species of insects, including defoliators, bark feeders and sap suckers are known to be associated with living trees of *D. latifolia*. A few fungal problems like rust disease, sooty mould, root rot and white rot have been reported on this species. The damage caused by them is found to be significant during flowering stage, as the attack results in damage to flowers/ premature falling of flowers, even though there is no serious threat from any of them in the establishment of nurseries or plantations.

Slate flash

Photo Credit: R. Ratheesh, IFGTB, Coimbatore

Tree Improvement

Selection of superior genotypes has been made and an experimental seed orchard is established in Karnataka. *In-situ* conservation has been initiated at Nagarahole, Coorg, India (Devi Prasad and Sukandi, 1994). Genetic combing works were undertaken by the Tamil Nadu Forest Department and 18 candidate plus trees have been identified (Subramanian, 1992).

In Java, two varieties of *D. latifolia* are recognized. The native variety, called "sonokeling", which seldom produces seeds and the naturalized variety of Indian-origin, called "sonobrits", produce seeds annually (Devi Prasad and Sukandi, 1994).

Agroforestry Practices

D. latifolia is a popular agroforestry species in Indonesia. Trees are spaced widely, 3 x 1 to 6 x 2 m, with intercrops of upland rice, maize, beans or cassava during the first three years. In other systems the species is planted with mango, annona, jackfruit, and guava. When the tree canopies begin to close, shade tolerant crops like turmeric and ginger are under planted (Sukandi, 1993).

Leaves are used as fodder. The tree is grown in coffee plantations as a shade tree. It is known to be a nitrogen fixing tree. The leaf litter of *D. latifolia* decomposes slowly thereby releasing nutrients gradually and it is used as mulch. Like other member of the genus *Dalbergia*, flowers of the species produces good amount of nectar and its honey is dark amber and strong flavoured (Agroforestry Tree Database, 2009). Hence it is a suitable species, which can support apiculture.

Table 2. Flower visitors and pollinators of *Dalbergia latifolia*

S.No.	Scientific name	Common name	Frequency of visit
I	FLOWER FEEDING		
1	*Megalaima viridis* (Boddaert)	Small Green Barbet	Infrequent
2	*Psittacula cyanocephala* (Linnaeus) Male	Plum headed parakeet	Infrequent
	Female		Frequent
3	*Pycnonotis cafer* (Linnaeus)	Red vented Bulbul	Very frequent
II	INSECT LARVAE FEEDING		
4	*Pycnonotis cafer* (Linnaeus)	Red vented Bulbul	Very frequent
5	*Dendrocitta vagabunda* (Latham)	Rufous treepie	Infrequent
6	*Lonchura striata* (Linnaeus)	White Rumped Munia	Frequent
7	*Merops leschenaulti* Vieillot	Chest nut headed bee eater	Infrequent
8	*Dicrurus macrocercus* Vieillot	Black Drongo	Infrequent
III	NECTAR FEEDING		
9	*Nectarinia minima* (Sykes)	Sunbird	Frequent
10	*Neptis hylas* (Linnaeus)	Common sailer	Frequent
11	*Euploea core* Cramer	Common crow	Frequent
12	*Hypolimnas misippus* (Linnaeus)	Danaid eggfly	Frequent
13	*Prosotas nora* (C.Felder)	Common lineblue	Frequent
14	*Rapala manea* (Hewitson)	Slate Flash	Frequent
15	*Apis cerana indica* Fabricius	Indian honey bee	Frequent

Growth, Yield and Economics

The species exhibits typical slow growth and can be enhanced through fertilization, soil moisture conservation and weed control. The trees were found to reach 58 cm diameter in 80 years in Mysore and 110 years in Kurnool. In the mixed deciduous forests of Wayanad (Kerala), the trees were estimated to reach 60 cm diameter in 148 years. A maximum diameter growth of 3 metres has been reported in Karnataka, India (Prasad *et al*., 1993). The growth in the Southern Tropical Semi-evergreen and Moist Deciduous Forests of North Canara is found to be slow and in this locality, *D. latifolia* is found to take 238 years to reach a diameter of 60 cm (Tewari, 1995). The annual girth increment recorded in some of the plantations in Tamil Nadu is 3 cm, between the age of 10 and 18 years. In a 25 year old plantation in Purwakarta, West Java average diameter at breast height (1.30 m above the ground) was 26.1 cm and tree height 20.3 m (Sukandi, 1993).

Indian Rosewood has high export value. A study conducted in Karnataka on the production and prices of Rosewood up to 1990 revealed that its production is falling down at the rate of 23 per cent, while its price is rising at the rate of 10.2 per cent (Rai and Sarma, 1992).

D. latifolia tree (GBH: 212 cm), Bargur, Erode

Photo Credit: K.R.Sasidharan IFGTB, Coimbatore

Wood Properties/ Utilization

The timber of *D. latifolia* is stronger and much harder than teak and has a slightly higher elastic limit than Burma teak (Pearson and Brown, 1932). Indian Rosewood can be seasoned either in the air or in the kiln. It darkens in colour during kiln seasoning, thereby gaining value. The heartwood is very hard, weighing about 850 kg/m^3. The hardwood is durable and no treatment against insects and fungi is required. But the sapwood is perishable and hence needs treatment with preservatives.

Indian Rosewood is one of the best woods for furniture and cabinet works. It is also a valuable decorative wood suitable for carving and ornamental ply-boards and veneers. It is especially useful for pattern making, calico printing blocks, mathematical instruments and screws. The wood is also used for gun carriage wheels, ammunition boxes, army wagons, pulleys, handles, shelves, decorative carriage parts, temple cars, boat knees, well construction, agricultural implements, combs and razor handles. Though it is expensive, Indian Rosewood is also used for door and window frames (Anon, 1952).

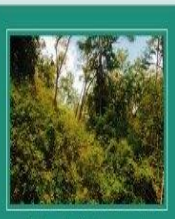
Medicinal Uses

Parts of the tree are reported to be useful as stimulant and appetizer and also in dyspepsia, diarrhea, leprosy, obesity and worms (Anon, 1952). Tannins extracted from the bark are used for a number of medicinal purposes.

Population status and conservation

The natural population of this species is fast depleting in the wild. Studies conducted recently have shown that *D. latifolia* populations distributed in the natural forests of eight forest divisions of Tamil Nadu and Kerala is very low (Table-3). It ranged from 1 tree/1.25 ha to 44 trees/1.25 ha. The maximum number of *D. latifolia* in lower girth classes recorded was 7/ 1.25 ha, while in the higher girth classes the occurrence was less than one tree per 1.25 ha of forest area (Muraleekrishnan *et al*., 2014). As per the IUCN Red List of Threatened Species, *D. latifolia* is categorized as "Vulnerable" and the over-exploitation of the species from wild for timber has been attributed as the major threat factor encountering the species. Our studies have revealed that poor natural regeneration of this species is also contributing to its population decline, leading to vulnerable status. Invasive weeds like *Lantana camara*, *Mikania micrantha*, *Chromolaena odorata*, *Hyptis suaveolens* etc. and occurrence of fire during summer season affected the natural regeneration. The status of regeneration showed that in most of the locations studied, the natural regeneration is low and the sapling stages are very poorly represented (Table-4). Considering the fast dwindling population of *D. latifolia* in the wild, concerted efforts are urgently required to conserve the precious genetic resources, by adopting both *in-situ* and *ex-situ* strategies.

Thick growth of *Mikania micrantha* in the forest areas at Machad Forest Range, Thrissur



Thick growth of *Lantana camara* in forest areas, Bargur, Erode

Natural regeneration of *D. latifolia* at Machad Forest Range, Thrissur

D. latifolia population, Singapathi, Siruvani foot hill, Coimbatore

Photo Credit: K.R. Sasidharan, K. Muraleekrishnan & S. Prakash, IFGTB, Coimbatore

Table 3. Population status of *D. latifolia* in various forest areas of Tamil Nadu and Kerala

S. No.	Girth class (cm)	Forest Division (No. of trees/1.25 ha)								Mean No. of trees per1.25 ha
		1	2	3	4	5	6	7	8	
1	31-60	2	11	6	1	4	15	0	3	5.25
2	61-90	9	8	1	2	8	19	0	9	7.00
3	91-120	6	10	0	8	5	5	1	13	6.00
4	121-150	8	2	0	2	2	0	0	7	2.63
5	151-180	3	2	1	1	2	0	0	6	1.88
6	181-210	2	0	0	0	0	1	0	3	0.75
7	211-240	0	2	0	0	0	1	0	1	0.50
8	241-270	0	0	0	0	0	0	0	2	0.25
9	271-300	0	0	0	0	0	0	0	0	0
10	301-331	0	0	0	0	0	0	0	0	0
11	331-360	0	0	0	1	0	0	0	0	0.13
	Total	30	35	8	15	21	41	1	44	

1 - Coimbatore, 2 - Erode, 3 - Salem, 4 - Palakkad, 5 - Mannarkkad
6 - Thrissur, 7 - Nemmara, 8 - Chalakkudy

Table 4. Regeneration status of *D. latifolia* in various forest areas of Tamil Nadu and Kerala

Category	Forest Division/ Density (per100 m²)							
	1	2	3	4	5	6	7	8
Trees (>30 cm gbh)	0.24	0.28	0.06	0.11	0.16	0.33	0.008	0.35
Saplings (10-30 cm girth)	0.08	0.08	0.24	0	0	2.40	0.08	0
Seedlings (<10 cm girth)	0.16	0.48	1.12	1.52	8.24	15.40	1.84	1.20

1 - Coimbatore, 2 - Erode, 3 - Salem, 4 - Palakkad, 5 - Mannarkkad
6 - Thrissur, 7 - Nemmara, 8 - Chalakkudy

References

Agroforestry Tree Database, 2009. A tree species reference and selection guide *Dalbergia latifolia*. http://www.worldagroforestry.org/SEA/Products/AFDbases/AF/asp/SpeciesInfo.asp?SpID=1726

Anon 1952. The Wealth of India, Raw Materials, Vol.III. Council of Scientific and Industrial Research, New Delhi.

Cameron 1894. The Forest Trees of Mysore and Coorg. Govt. Press, Bangalore.

Deshmukh, D.K. 1975. Regeneration of Rosewood *(Dalbergia latifolia,* Roxb.) Myforest 11 (2): 87-93.

Devi Prasad, A.G. and Sukandi. T., 1994. *Dalbergia latifolia* - the high-valued Indian rosewood. NFT Highlights. NFTA 94-04. Winrock International.

Direktorat Reboisasi dan Rehabilitasi (DMI). 1980. Pedoman Pembuatan Tanamam Jakarta: DMI, Ditjen Kehutanan. pp. 75-84.

Joker, D. 2004. Seed Leaflet: *Dalbergia latifolia* Roxb. No. 90 August 2004.

Kadambi, K. 1954. The Silviculture of *Dalbergia latifolia*. Monograph of Indian trees, No.1. Government of India, Manager of Publications, Delhi.

Muraleekrishnan, K., Sasidharan, K.R., Kunhikannan, C. and Prakash, S. 2014. Some observations on the population structure, regeneration and reproductive biology of *Dalbergia latifolia* and *D. Sissoides*. Abstract Proceedings, Indian Biodiversity Congress-2014, S.R.M. University, Chennai, *pp.41.*

Pearson, R.S. and Brown, H. P. 1932. Commercial Timbers of India. Govt. Press, Kolkatta.

Prasad, A.G. D., Chandra, K. S. J. and Reddy, A. N.Y. 1993. Initiation of a genetic improvement program for *Dalbergia latifolia* in Karnataka, India. Paper presented at the International Dalbergia Workshop, 31 May - 4 June, 1993. Hetauda, Nepal.

Rai, S.N. and Sarma, C. R. 1992. Teak, Rosewood, softwood and bamboo production and prices in Karnataka. J. Tropical Forestry 8 (3): 238-243.

Soekeri. 1979. A possibility on modification of the sonokeling planting technique. Duta Rimba 5 (35): 20-26.

Subramanian, K.N. 1992. Status of Tree Breeding and Propagation in India. Report presented in the Project Advisory Committee Meeting (PAC) conducted at Ecosystem Research and Development Bureau College, Laguna, Philippines, on 27-29 May, organized by FAO/UNDP Regional Project on Improved Productivity of Man-made Forests through Applications in Tree Breeding and Propagation (RAS/91/004).

Sukandi, T. 1993. Agroforestry-based plantations of *Dalbergia latifolia* Roxb. in Java, Indonesia. Paper presented at the International Dalbergia Workshop, 31 May - 4 June, 1993. Hetauda, Nepal.

Tewari, D.N., 1995. A Monograph on Rosewood (*Dalbergia latifolia* Roxb.) International Book Distributors, Dehra Dun.

Troup, R.S. 1921. The Silviculture of Indian trees, Vol.1. Oxford University Press, Oxford.

K.R. Sasidharan, K. Muraleekrishnan
C. Kunhikannan & S. Prakash
IFGTB, Coimbatore

Growth Promoting "Tree Rich Biobooster"

A growth promoting product "Tree Rich Biobooster" using organic ingredients for growth improvement of fast growing trees species such as *Casuarina, Gmelina, Ailanthus, Melia*, Teak, *Neolamarckia* and *Eucalyptus* has been developed at IFGTB, Coimbatore. IFGTB has isolated and maintained different strains of bio-inoculants Azospirillum, Phosphobacteria, Frankia and AM fungi. Mixtures of these bioinoculants were subjected to hydraulic pressure to make disc/pellet of 60 mm/25 mm size with 50-60 g weight. The pellet would expand to 12 cm height and 6 cm diameter on adding 350 ml of water which can be placed in a standard (6 X 15 cm) polybag for raising seedlings. Cost per pack: Rs. 30/-.

Biopesticide - Hy-ACT & TreePAL®

"Hy Act & TreePALH© "- two new seed oil based biopesticides developed from *Hydnocarpus pentandra* as a base in combination with pongamia, neem and lantana oils were evaluated against key insect pests of *Ailanthus, Casuarina* and Teak. Preliminary studies (laboratory and field conditions) revealed that the oil possesses insecticidal properties against pests of the above species with a larval mortality rate for *Hyblea purea* (80-90%), *Inderbella quadrinotata* (60-80%) and *Eligma narsisuss* (45-55%). The formulation is also found to act as feeding deterrents, growth inhibitors, repellents (or) oviposition inhibitors against the target species. A 100 ml formulation (combination of both) in 10 litres of water can save 1.5-2.0 lakhs seedlings. Cost per bottle: Rs. 80/-.

PACKAGE OF PRACTICES FOR SEED HANDLING AND NURSERY RAISING FOR *SWIETENIA MACROPHYLLA* KING (MELIACEAE)

Swietenia macrophylla King (Meliaceae) popularly known as big-leaved mahogany (also known as American mahogany or Bastard mahogany or Honduras mahogany) is a potential tropical timber species introduced from Honduras into India (Kolkata Botanical Garden) in 1872 and has been cultivated in many parts of the country including Tamil Nadu because of its wood quality. The wood is used for construction of high value furniture and interior decorations. It has also been planted for soil conservation and in the establishment of greenbelt in industrial areas.

Seed propagation is the principal mode of reproduction in this species. It is an annual seed producer and hence flowering and fruiting occurs regularly but with timings varying between localities. Its seed production and availability fluctuates considerably annually. Generally, seed productivity is much less in plantations than in isolated/avenue trees. Moreover, only few fruits develop on the otherwise profusely blooming branches which contains 126-210 flowers. Some trees do not produce flowers and fruits at all. Our study carried out at KFRI revealed that flower drop, heavy immature fruit fall within a fortnight after fertilization and the insect, *Hypsipyla robusta* infestation during early stages of seed development are the main causes for low seed production in mahogany. The fruit takes 262 days to become fully mature. The capsule remains attached to the tree during seed dispersal; mostly fruit parts such as valves and seeds are shed leaving the fruit stalk on the tree. However, the whole fruit may fall sometimes. Seeds are dispersed by wind.

The seeds are available for collection about six months usually from November to April. The capsules should be harvested from the trees when few capsules starts dehiscence (also when some leaflets begins to fall), gathered in cotton gunny bags, loosely packed and transported, and processed without any delay as they are liable to be infested with fungi within 2-3 days of collection. Seeds can be extracted from the capsules by placing them under direct sunlight. On an average a capsule contains 40-48 germinable seeds. As the seeds are winged, the wings should be removed which not only helps in seed handling but also reduce storage space. For storage, either the de-winged seeds are air-dried thoroughly to a low moisture content of about 4% and stored in air-tight containers, preferably in sealed polybags (700 gauge thickness) under cold conditions at 2°C ± 1 or the de-winged seeds are air-dried to moisture content of about 10-12% and stored in similar containers but at warmer temperatures of 10 to 15°C. Tetrazolium test can be performed to assess seed viability quickly.

Care should be taken during seed sowing as seed orientation at the time of sowing significantly affect both the germination percentage as well as seedling growth. To raise seedlings in the nursery, de-winged seeds are sown by dibbling in horizontal position either in vermiculite or garden soil or river sand on raised seed bed under shade and watered regularly. After 45 days of germination, the seedlings are pricked out and potted in containers such as polythene bags of size 22.5 x 17.5 cm and root trainers of 15 cm length and 310 cc capacity filled with the potting medium soil: sand: compost (3:1:1 ratio). Polypotted seedlings are ready for field planting after 3 months while root trainer seedlings after 5-6 months. However, the polypotted seedlings can be kept for up to 5 months in the nursery since root coiling occurs afterwards whereas root trainer seedlings can be kept for more than one year in the nursery.

S. ABDUL KADER &
K. K. SEETHALAKSHMI*
Presidency College, Chennai &
* Kerala Forest Research Institute, Peechi.

Swietenia macrophylla

Seeds

Forthcoming Events

JUNE 2015

- International Conference on Reforestation Challenges - Belgrade, Serbia 03-06 June 2015

JULY 2015

- 4th International Conference on Forests and Water in a Changing Environment - Kelowna, BC, Canada 06-09 July 2015
- Mountain Forest Management in a Changing World - High Tatra Mountains, Slovakia 07-09 July 2015

AUGUST 2015

- Forest Genetics 2015: Integrating Tree Breeding, Silviculture, and Growth and Yield - Fredericton, New Brunswick, Canada17-20 August 2015
- Genetics of Tree-Parasite Interactions - Orléans, France 23-28 August 2015

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.

ENVIS Activities at IFGTB

On the World Forest Day, 21st March 2015, a presentation was given by the ENVIS Team to a gathering of School children at YWCA Matriculation Hr. Sec. School Auditorium, Coimbatore on the theme "Forests, their Types, Significance and Conservation". An Environmental Quiz booklet containing multiple choice questions related to environment and forest biology along with their answers was distributed and issued to different schools in Coimbatore. An awareness poster on Tree improvement was distributed to the Trainee Deputy Forest Range Officers from Forest Training Centre at Arippa, Kerala and students from different Universities/colleges.

About ENVIS

ENVIS established by the Government of India, in 1982 has been providing environmental information to decision makers, policy planners, scientists and engineers, research workers, etc. all over the country. It is a comprehensive decentralized information system on environment involving effective participation of institutions / organisations in the country actively engaged in work relating to different subject areas of environment. A large number of nodes, known as 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 & Forests.

Instructions to contributors

Dear Author/ Subscriber/ Contributor,

We invite contributions to the ENVIS Newsletter issues!

The ENVIS Centre 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 Centre. 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

ENVIS Team

R.S. Prashanth, IFS — Director
Dr V.N. Mutharaian — Programme Officer
Dr Kannan C.S. Warrier — Scientist E and Coordinator, ENVIS
T. Vamadevan — Information Officer
Dr Rekha R. Warrier — Scientist E and Editor
V. Thangavel — IT Assistant

INSTITUTE OF FOREST GENETICS AND TREE BREEDING
Forest Campus, P. B. No. 1061, RS Puram HPO, Coimbatore - 641 002
Phone: 91 422 2484100; Fax: 91 422 2430549