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Van Sangyan

Editorial Board

Note to Authors:

We welcome the readers of Van Sangyan to write to us about their views and issues in forestry. Those who wish to share their knowledge and experiences can send them:

by e-mail to vansangyan_tfri@icfre.org

or, through post to The Editor, Van Sangyan,
Tropical Forest Research Institute,
PO-RFRC, Mandla Road,
Jabalpur (M.P.) - 482021.

The articles can be in English, Hindi, Marathi, Chhattisgarhi and Oriya, and should contain the writers name, designation and full postal address, including e-mail id and contact number.

TFRI, Jabalpur houses experts from all fields of forestry who would be happy to answer reader's queries on various scientific issues. Your queries may be sent to The Editor, and the expert's reply to the same will be published in the next issue of Van Sangyan.

Cover Photo: Panoramic view of Achanakmar-Amarkantak Biosphere Reserve
Photo credit: Dr. N. Roychoudhury and Dr. Rajesh Kumar Mishra, TFRI, Jabalpur (M.P.)

From the Editor's desk

Without any protective treatment, most bamboo species have an average natural durability of less than two years. Stored under cover, untreated bamboo may last four to seven years. These variations in bamboo durability strongly depend on the species, the length of the culm, the thickness of the wall, but also, and equally important, the time of harvesting. The lower portion of the bamboo culm is considered more durable, while the soft inner part of the wall deteriorates faster than the outer harder portion. This is related to the anatomical and chemical nature of the woody cells. Although some of the characteristics of bamboo resemble those of wood, its growth characteristics and microstructure is different. Unlike timber varieties like teak, the structure of bamboo is void of toxic deposits.

The large amounts of starch present in bamboo makes it highly attractive to mold and fungi, termites and powder-post beetles. They cause much damage during drying, storage, and subsequent use. Tests have also shown that bamboo is more prone to soft rot and white rot attack than to brown rot. Bamboo consists of 50-70% hemicellulose, 30% pentosans, and 20-25% lignin. The lignin present in bamboos is unique, and undergoes changes during the growth of the culm. Bamboo is also known to be rich in silica (0.5 to 4%), but the entire silica is located in the outer layer (1 mm), with hardly any silica in the rest of the wall. Bamboos also have minor amounts of waxes, resins and tannins, but none of these have enough toxicity to improve its natural durability.

We think it is important to promote the correct use of bamboo in order to increase the durability, utilization, and popularity of this versatile and environmentally friendly material. Increasing the shelve-life of bamboo to 50 years or more is certainly possible by applying the appropriate treatments which is also more economical and sustainable in the long run.

This issue of Van Sangyan contains an article on Transfer of bamboo treatment techniques in rural areas of Tripura. There are also useful articles, such as Forensic botany in criminal investigations-a review, Inventory of understory vegetation in degraded landscape of collieries, Diversity of Amylosporus campbellii in central India, Gender significance in forestry and agroforestry, Bridge between commerce and subsistence through Borassus flabellifer based agroforestry, Arnebia benthamii (Wall.ex.G.Don) Johnston- a medicinally important plant, Mahogany (Swietenia macrophylla King): a suitable timber species for agroforestry, Mahogany (Swietenia macrophylla King): a suitable timber species for agroforestry, Tree diversity of tropics, Wild Silkworm, Attacus atlas Linnaeus (Lepidoptera: Saturniidae) and Biodiversity of Crataeva religiosa and Apteryx australis.

I hope that readers would find all information in this issue relevant and valuable. Van Sangyan welcomes articles, views and queries on various issues in the field of forest science.

Looking forward to meet you all through forthcoming issues.

Dr. N. Roychoudhury
Scientist G & Chief Editor

Contents

Transfer of bamboo treatment techniques in rural areas of Tripura

Pawan K. Kaushik and Atanu Saha
Centre for Forest-based Livelihoods and Extension
Agartala

Bamboo is the principal Non Timber Forest Produce (NTFP) in Tripura and the people of Tripura use it extensively for different purposes. The State is bestowed with 3246 km^2land as bamboo bearing area out of 6294 km^2 of Reserve Forests. About1.49 lakh of artisans are producing crafts made of bamboo and 20000 artisans are engaged in Bamboo handicrafts in Tripura. It is estimated that around 6.1 million manday is generated per annum by way of management, harvesting and utilization of Bamboo.

Bamboo has acquired a foremost space in construction, household use and many other purposes in rural as well as urban areas. Early decaying of bamboos has been the greatest problem to continue with these traditions. Bamboo treatment technique needs to be extended to the target users for minimizing the consumption of bamboo resources as well as to save their labor, time and money. This will also help in earning their livelihoods by promoting their products made out of treated bamboo in the local and global market.

The high strength, low cost and versatile use of bamboo have made it unique and unparalleled to any other timber for making items from cradle to coffin. Keeping in view its short natural durabilitywhich is just 1-2 years under the outdoor uses like fencing etc. depending on different kind of species, use of treated bamboo products has become a necessity.Variety of fungi and insects is the prime cause for biodegradation resulting into reduction in durability and strengthof bamboos products. Household consumption pattern of bamboos in the Northeast states reveals that about 70% of the bamboos are used for construction and repair of houses and fences. The structures made of untreated bamboosoften require intermittent replacement of bamboos which consumes lot of time in maintenance and also involves cost of material and labor more frequent. If such intermittent replacements can be avoided, the bamboo resources may be conserved, sold or used for other purposes, which would certainly contribute toraise their economic conditions.

Bamboo treatment technique has both tangible and intangible benefits. The tangible benefits include avoidance of intermittent replacement of specimen, cost on material and labour involved therein, enhanced service life of treated material, availability and supply of raw material during lean period. These tangible benefits are crucial in poverty alleviation. While intangible benefits of bamboo treatment technique include increase in biomass by restoration of healthy bamboo cover, strengthening the Carbon Sinks, check in soil erosion, increasing soil fertility and leading towards sustainable harvesting by minimizing pressure from market forces.

Method of bamboo treatment

The durability of bamboos can be extended up to 3 to 5 times by chemical treatment. There are two methods of chemical treatment

– by soaking manually and by treating with Boucherie apparatus**.**

Bamboo treatment technique – Soaking and boiling method

(Chemical Soaking Process)

In a GI Sheet made tank, CCB is mixed with water at desirable concentration i.e. 4% - 10 % as per the purpose of the treatment of bamboos in terms of utilization. It is boiled for 1 hour and left for soaking till it cools down to room temperature.

Bamboo made Treatment Tank at Noagaon

Bamboo Treatment Centre at TRIBAC in Tripura

Boucherie Method of Bamboo Treatment at BamutiaTripura

Boiling Method of Bamboo Treatment at CFLE Campus

Bamboo treatment technique - by pressure machine (Boucherie method)

This method of treatment is widely recognized process. It is suitable for freshly felled bamboos with or without branches and leaves. In this process, one end of the bamboo is connected to the reservoir containing the treatment media through a coupling unit. The hydraulic pressure pushes the treatment mediathrough the wall of fresh bamboo and thereby the sap is drained out and replaced with the chemical.

Preparation of treatment media

Readymade chemicals like CCB are readily available in the market or desired botanical extracts may be used. To prepare a treatment mediaof 8 % CCB in 20 liters of water: take 1.6 kg of CCB.

In absence of readymade treatment media; it can be prepared with the available chemicals for example Boric Acid Borax (Ba. B). Chemical solution using Boric Acid Borax is used in 1: 1.5 ratio.

1. Take the required amount of preservative salts.
2. If more than one type of salt is required to as in Boric acid Borax (Ba.B), Copper Chrome Boron (CCB), first thoroughly mix the dry salts together.
3. Mix all the salts and dissolve it in little some water (say 1 liter water), or any other solvent as the case may be, and then add water (solvent) to make the total volume of the required preservative.
4. It is important to note that there should not be any particulate matters in the preservative solution.

Bamboo for treatment

1. Insert any one side of the freshly cut bamboo into the hosepipe / couple and tighten with the help of hose clamp/ screws so as to make it leak proof. If required rubber tubing may be wound round the bamboo to make it lead proof.
2. The opposite of the bamboo may be kept at horizontal level with the help of supports. It is better to keep the open end on a slightly elevated position
3. Through the air inlet, gently increase the air pressure in the tank with the help of pump, until the pressure gauge indicates a pressure buildup of 1 kg/cm2 or as required.
4. Slowly open the start valve to begin the bamboo preservative treatment process.
5. The process of treatment is said to be complete when the specific gravity of the liquid dripping out of the open end of bamboo (effluent) is equal to the specific gravity of preservative solution used.

SWOT Analysis conducted with the beneficiaries of Noagaon, Bamutia, West Tripura and Kanchanpur, North Tripura for the treatment of bamboos by CCB chemicals

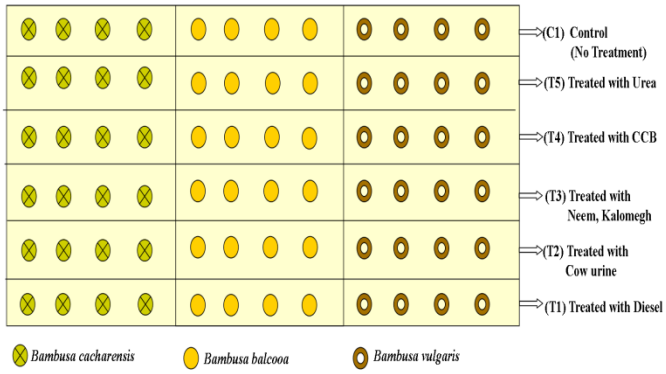
Strength	Weakness
1. Machine is handy suitable to carry. 2. Qualified trainings are available by support organization 3. Adoptable technology 4. Bamboo can be treated quickly 5. The machine is portable and transported to rural areas.	1. The chemicals are not readily available in the local market. 2. It is difficult to get ready market for selling treated bamboos. 3. The machine requires maintenance.
Opportunities	**Threats**
1. Production of value added items. 2. Judicial use of the available natural resources 3. Expansion of market potential 4. Durability increase of Bamboo byproducts. 5. SHGs and women involvement 6. Additional income generation for poor people	1. Precautions are required for operation of the pressure machine. 2. Cattle may consume the toxic chemicals which are used for treatment.

Training and field demonstrations

CFLF had conducted about 15 nos. trainingon Bamboo treatment technique and preservation process of bamboo comprising 360 participants throughout the state of Tripura. Trainings were conducted at Bamutia, Noagaon, Borjush, Khaschowmuhani, Kanchanpur, Agartala area.

Graveyard trials and field demonstrations

The graveyard trials were conducted at CFLE campus at Agartala during November 2015 to find out the durability of different chemicals, oils and biological extracts.



Results of graveyard test of bamboo

The response of bio-materials as treatment media were observed to be significantly effective in all the three species as compared to the control, over the period of 9 months under Graveyard Test at CFLE Campus.

***Bambusa balcooa* (Barak Bamboo), Period of trial : Nov. 2015 to Aug 2016**

***Bambusa vulgaris*(Bari Bamboo), Period of trial : Nov. 2015 to Aug 2016**

***Bambusa cacharensis* (Bom bamboo), Period of trial : Nov. 2015 to Aug 2016**

The initial graveyard test at CFLE Agartala was conducted during July 2013with treated bamboo poles byusing Boucherie methods with CCB treatment mediato compare with the performance of the untreated bamboo poles. After two years in July 2015, it was observed that treated bamboo pole of *Bambusa vulgaris* were better condition and may last for another two years. Whereas,the untreated bamboo poles were found completely damaged below ground and almost decomposed and fully infected with termite population.

Untreated Bamboo Poles **Treated Bamboo Poles**

Popularity of boucherie apparatus in Tripura

The Boucherie machine has been adopted by several groups in different parts of the State. These machines are in regular use and the users are also getting advantages of the techniques to generate direct and indirect incomes from the treated bamboos. The details of users are as follows –

Boucheries Machines and Treatment Tanks spared to –

- Mars Socio Welfare Society (MSWS), Kanchanpur
- Noagaon Bamboo Growers' Society (NBGS), Noagaon
- Neermahal Crafts, Khashchoumuni
- Nava Jagaran SHG, Nalchhar
- DISHARI NGO, Belonia
- TRIBAC, Agartala
- Mithai Bamboo Furniture Group, Kalibazar (through NBGS)
- Ananya SHG

It has got popularity among those who are engaged in making, furniture, handicrafts and jewelries. Some of the groups have come up to adopt the techniques for the purpose of housing and other structures.

Bamboo treatment centresunder CFLE

CFLE has established small scale Bamboo Treatment and Technology Demonstration Centres in different locations in the State, as follows –

- Bamboo Treatment and Demonstration Centre, Gandhigram (in Collaboration with TRIBAC)
- Bamboo Treatment Centre, Kanchanpur, in collaboration with MSWS)
- Bamboo Treatment Centre, Noagaon
- Bamboo Treatment Centre, Khashchoumuhani

Entrepreneurship development and commercialization

Bamboo treatment techniques have ample potential to promote microenterprise in both urban and rural areas in Tripura as well as in other NE States. It converts bamboos into alternate materials for buildings and round pole bamboo furniture with enhanced durability. It creates employment opportunity and also encouragessustainable harvesting, proper treatment followed bysemi-processingin view of various utilities. A prospective entrepreneur could easily take a lead to accelerate commercial supply of treated bamboos. Branding and quality assurance gives an additional importance to promote such enterprise. A viable business plan is needed to avail the working capital from bank and financial institution and a push-based marketing approach may help to identify and reach the potential buyers. A new enterprise set-up for this newly introduced product needs psycho-social support through business counseling to develop the moral of the entrepreneur; it could be done by providing exposure to utility prospectsthrough training and capacity building.

The small producer groups may form a producer's organization at farm level to set-up commercial units of bamboo treatment. The community level participatory mechanism will facilitate the sale of treated bamboo directly from farm to market. To begin with, the existing bamboo market could be a contact point to stock and display the treated bamboos of different species, specification and sizes. Later the producer groups may get orders to deliver the treated raw material in customized manner from the buyers/traders.

Recently, Tripura Bamboo and Cane Development Centre (TRIBAC) - a social enterprise based in Agartala, Tripura has taken an initiative and set-up treated bamboo production unit with minimum capital investment on Boucheriemachine and Low-cost Treatment Tanks with chemical and initial raw materials. TRIBAC has come up with treated bamboos of different species of commercial utilities with a Brand '**TryBam'** through technical support from Centre for Forest-based Livelihood and Extension (CFLE), Agartala, Tripura. In a collaborative approach with CFLE, TRIBAC has beenorganizing training and demonstration for capacity building for new entrepreneurs and is also engaged in push-based marketing of treated bamboos for housing, furniture and household fencing. The prototype bamboo treatment machine has also been expanded by TRIBAC in Bihar, Meghalaya and Tripura. The pro-poor bamboo treatment technique has been extended in rural pockets like Kanchanpur, Melaghar and Bamutia of Tripura for producing treated bamboo for use in construction and fencing. Apart from the Disaster Risk Reduction in quake prone zones, it will also create an alternative livelihood among the rural poor through

setting-up Bamboo Treatment Units to supply quality bamboo building components under Indira AvasYojana (IAY) housing scheme.

It is believed that the awareness generation and community entrepreneurship development in both rural and urban areas will create a high demand of treated bamboos in near future with a positive trend of lowering down the quantum of resource consumption at the same time. And therefore, CFLE plans to extend it further to reach the unreached with the support of local NGOs and various volunteer groups.

Forensic botany in criminal investigations-A review

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Abstract

Forensic Science is often defined as the claim of scientific methods and techniques for the purposes of justice. Forensic science can prove the guilt and it can help to decide a broad spectrum of legal issues in civil actions through the identification, analysis and assessment of physical and other proof. Botany and palynology are now accepted as part of the weapons store of forensic technique. These disciplines have been tested in court and have provided proof for contact of matter and places, location of person remains and critical, estimating times of evidence of bodies, differentiating murder sites from evidence sites, and the origin of objects and materials. It is important that the forensic palynologist is an experienced botanist. Even though forensic palynology has been successfully used as a crime fighting tool for over 50 years it is still not generally used in either social or criminal cases except in a few select countries.

Keywords: Criminal investigations, Forensic Botany, Palynology

Introduction

The word Forensic, itself comes from the Latin word *'forensis'* meaning of the forum. It originally applied to the marketplace areas within ancient Rome where many types of businesses and public affairs, such as governmental debates and actions by courts of law, were conducted. Entering the English vocabulary in 1659, the modern meaning of forensic is now limited to the areas of legal and criminal investigations. The first recorded case of the use of spores and pollen to solve a serious crime (forensic palynology) was in Austria over 50 years ago. A man on a journey down the Danube River disappeared near Vienna, but his body could not be found. Another man, with a motive for killing him, was arrested and charged with his murder. Without a confession or a body the prosecutor's case seemed likely to fail. As the investigation proceeded, mud from a pair of the defendant's shoes was given for analysis to the palynologist Wilhelm Klaus of the Department of Palaeobotany, University of Vienna. Klaus determined that the mud contained modern spruce, willow, and alder pollen, as well as 20 million year old fossil hickory pollen grains, which had eroded from exposed sediment of Miocene age. Only one small area 20 km north of Vienna, along the Danube River, had soil developed on the required Miocene rocks and a forest consisting primarily of spruce, willow and alder. When the defendant was confronted with the identity of this locality he confessed his crime and led authorities to the precise site where he had buried the body. This region was in the area pin-pointed by Klaus. Forensic palynology can also be used to focus a line of inquiry for the Police without actually leading to the provision of concrete evidence able to be presented in court. A number of case histories and scientific papers have been published outlining the successful applications of forensic palynology to the solution of criminal activities.

Materials and Methods

Spores and pollen, often collectively identified as pollen, are used as a means of dispersal and reproduction by plants. Pollen are produced within anthers in flowers (from flowering plant parts) and modified leaves as cones (from gymnosperms or conifers) and carry the male sex cells from one plant to the female part of the flower or the female cone of a different plant in the same species for fertilization and seed production. Spores are produced in sporangia and other specialist organs and are the means of either sexual or asexual dispersal of lower plants and plant allies including algae, fungi, ferns, liverworts, hornworts, lichens and mosses. These spores and pollen grains depend on outside factors, like animals, water and wind to get from the parent plant to a suitable environment for germination or fertilization.

Uses of plants in criminal investigations

Forensic botany is the application of plant sciences to criminal investigations. A relatively new discipline, forensic botany incorporates several subdisciplines, palynology (the study of pollens), dendrochronology (the study of tree rings), limnology (the study of aquatic environments), systematics (classification of plants), ecology (the study of ecosystems), and molecular biology (the study of structures and functions of cells on a molecular level). Different forensic anthropologists, forensic botanists do not normally deal with human remains. Their primary role in an investigation is in making connections between evidence and a crime. For example, pollen can be used to connect a suspect to a victim or scene. Pollen is a powder-like substance released by plants as part of their reproductive cycle. Since it is produced in large volumes and is easily transported by wind, pollen grains are often found on clothes, hair or skin. If investigators find a rare plant type near a murder victim, the presence of its pollen on a suspect could place them at the scene. Even for common plants, each environment has its own unique combination of pollens, and this 'signature' can link an individual or object to a location. Pollen signatures may also indicate that a body has been moved or suggest the type of area where the original crime took place.

Survey of Literatures

Perusal of literatures on forensic botany, Willey & Heilman 1987; Lane *et al*.1990; Siver *et al*. 1994; Coyle *et al*. 2001; Doreen *et al*. 2002; Gilmore *et al*. 2003; Miller *et al.* 2005; Ward *et al.* 2005; Mildenhall *et al*. 2006; Horton *et al.* 2006; Craft *et al.* 2007; Ward *et al*. 2009; Zaya & Mary *et al.* 2012; Eurlings *et al.* 2013; Lancia & Conforti 2013 and Chandra & Sharma 2014. In this present study a description of forensic botany with its sub disciplines.

Palynology

Forensic palynology is the study of pollen, spores and other acid-resistant microscopic plant bodies, including dinoflagellates, to prove or disprove a relationship between objects, people and places that pertain to both criminal and civil cases. Palynology is the branch of botany that deals with the study of pollen grains, their shape, size, structure, length, origin, form, etc. Forensic palynology involves the solving of criminal cases with the help of identification of pollen grains and spores. Pollen grains being smaller in size are not seen by the criminal and thus remain at the crime scene helping the investigator to solve the crime. Pollen grains also help in fixing the location of the crime as certain

plants are found in particular areas and identification of their pollens and spores decide the location of the crime occurred. Pollen grains are microscopic and not visually obvious trace evidence during crime sight collection but are retained on clothing, embedded in carpets, pervasive in soil, etc. Pollen grain morphology can be used to identify a plant genus and often the species.

Anatomy

The building of plant's body and its components can provide a wide variety of forensic evidences. The rigid external cell wall covering the plant cells, unlike the animal cells, does not allow the plant cells to wash away or degenerate easily. In forensic science, the identification of wood is done on the basis of the physical and anatomical properties of wood. Physical properties include odour, weight, hardness, colour and texture of the wood sample. Water extract of some timbers show distinct fluorescence which helps in identifying the unknown wood samples. Anatomical properties include whether the pores are present or absent and if present then the further identifications done on determining the pore number, pore size and pore arrangement.

Ecology

Ecology is the branch of biology it deals with the relations of organisms to one another and to their physical surroundings. When we take plant ecology, it includes the distribution abundance of plants in an area, their effects upon environmental factor and interactions among and between plants and other organisms. Knowledge of ecology is useful for the forensic investigators in determining the relation of victims, crime scene and suspects. As a forensic ecologist one need to know several things in relation to ecology. Not, only the structure of plants but also their natural and semi natural habitat, biotic and a-biotic component of the habitat, how one species affect others, their possible and probable time of abundance, growth, structure and overall functions. In common plant, each environment has its own unique combination of pollen, and this name can relation an individual or object to a location. Pollen names may also indicate that a body has been moved or recommend the type of area where the original crime took place.

Results and discussion

Students around the world are studying various aspects of forensic palynology as research topics as universities sense an increasing demand for forensic palynologists and the science finds investigated in the intensive detail it deserves and needs. Many high profile court cases where forensic palynology has played an important role are coming to the notice. Thus the demand for this service grows. The general public is also now alert of the technique as a result of articles appearing on the Television, computer through internet, radio, newspapers, magazines, newsletters and books.

Future of forensic botany in India

Courses in forensic palynology have been run at the Department of Palynology and Botany in different Universities and Colleges of India for the last few years. These courses provide medical and biology students and officers with an opportunity to learn about this technique.

Conclusion

Forensic botany is not new but has as an important discipline in solving the secrecies and crimes. It is an interdisciplinary of various branches of botany where a forensic botanist has to obtain knowledge of different fields of

botany. New advancement in molecular technology investigation with application of forensic botany has become more exact and true. Using of plant based public database and its development according to the need of forensic analyst will help the investigating officer for easy and comparatively fast conclusion of the case.

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Inventory of understory vegetation in degraded landscape of collieries

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Abstract
The study was carried out at Kumda collieries of Bishrampur, Surajpur district of Chhattisgarh in three sites (Site-I represent upto 1 km circle from mining point, site-II from 1 km to 3 km and site-III represent more than 3 km circle from mining operation point) to evaluate the uderstory vegetation. A sum of 9 shrub species was found across the sites of Kumda collieries. The maximum number of species (7) was found in the site-II followed by site-I and site-III, respectively. The familywise distribution of shrub species revealed that a total of 6 familes were recorded across the mining sites. Site-II representing all the 6 families while site-I have 5 families and site-III have 3 families only. A wide variation was recorded in herbaceous species in the collieries sites of Kumda. A sum of 31 herb species across the site was recorded. In the site-I a total of 16 herb species were recorded while in the site-II total 20 herb species was found and in the site-III a sum of 26 herbaceous species were recorded. A long term strategy and proper planning is needed to conserve and restore the fragile ecosystem of Kumda collieries of Bishrampur. Furthermore, it is the need of the hour to implement strong legislative measures to curb negative consequences of mining operation on ecosystem and environmental.

Keywords: Collieries, Herbs, Mining, Shrubs, Understory vegetation

Introduction

Mining operations causes huge changes and damages to the landscapes and biological communities and its impacts and severity depends on methods and intensity of mining, whether the mine is operative or abandoned, and the geological conditions (Bell et al., 2001). The problems of overdumps become devastating to the landscape, resulted into disturbed the originality of site condition and the habitats become impoverished, presenting a very poor environment for plant growth and development. Various studies have emphasized to assess the vegetation structure and species diversity of an ecosystem influenced by mining activities (Dorren et al., 2004; Jhariya *et al*., 2013 & 2016; Kumar et al., 2015 & 2016). Measures of vegetation structure provide information on habitat suitability, ecosystem productivity and successional pathways (Silver et al., 2004; Wang *et al*., 2004) while species diversity provide information on susceptibility to invasion and trophic structures and interaction (Nicholas and Nicholas, 2003).

Mining is a key economic activity in most of the countries all over the world, because it facilitates raw materials for the human civilization and development of society. Operations, whether in small or large scale, are extremely disruptive and damaging to the ecosystem and environment. Furthermore, it accelerates the waste material production in huge quantities that can have deleterious impacts. In India, minerals are the basic

raw materials which contribute to the growth of countries; judicious utilization of mineral resources promotes the economic progress of a nation with least ecological damages. India ranks among the top five players worldwide in terms of production of various important key minerals. Traditionally, mines are the sole mineral supply source and exploration for coal is conducted without giving much regard to its serious and negative consequences on the ecology and environment. Therefore, the coal mining industry is being placed under the red category, due to its environmental degradation potential (Chaoji, 2002). The chief environmental impacts due to mining are changes in soil stratification, reduced floral and faunal diversity and alteration of structure and functioning of ecosystems; these changes ultimately influence water, nutrient dynamics and trophic interactions (Almas *et al*., 2004; Ghose, 2004).

Many opencast and underground mining centers are located in and around of the Bishrampur (Ambikapur in Sarguja division, Chhattisgarh). However, the last few decades it has seen that large scale unregulated mining, commercial and residential expansion, over straining of water resources and generally defunct civic amenities. Due to excessive mining in Bishrampur and its surrounding areas air, water and soil are continuously getting polluted and disrupting different environmental segments (Singh et al., 2013; Kumar et al., 2015, 2016). As large forest have been clear felled for opencast and underground mining of coal in the Bishrampur areas, the major challenges include loss of top soil, reduction of forest cover and destruction of habitats of ground flora species (Kumar et al., 2015, 2016; Jhariya et al., 2013, 2016; Jhariya and Yadav, 2016), which is essential for maintaining nutrient cycling and ecological balance. These are chemically, physically and biologically unstable and deficient. Therefore, in order to assess the effect of mining on understory vegetation in the Kumdra collieries of Bishrampur area, the present study was undertaken.

Material and methods

The presnet study was conducted at Kumda collieries of Bishrampur mining sites in Surajpur district of Sarguja division (Chhattisgarh), after the repeated reconnaissance survey of the area. Total of three sites were selected on the basis of the distance from the anthropogenic source or point/centre of the mining operations. Site-I represent upto 1 km circle from mining point, site-II from 1 km to 3 km and site-III represent more than 3 km circle from mining operation point in the collieries region. Thereafter sites were marked for measuring varying degree of disturbanc. In each site 5 x 5 m size quadrat was randomly laid for measuring shrubs species while the an another quadrat of 50 x 50 cm size was laid for measuring herbs, respectively. The data collected were then analyzed and complied for each sites.

Results and discussion

Shrubs cmpostion

A sum of 9 shrub species was found across the sites of Kumda collieries. The maximum number of species (7) was found in the site-II followed by site-I and site-III, respectively (table 1).

The familywise distribution of shrub species revealed that a total of 6 familes were recorded across the mining sites of Kumda collieries. The site-II representing all the 6 families while the site-I have 5

Table 1: Occurance and distribution of shrub species in different sites of collieries

Species	Site-I	Site-II	Site-III
Caesalpinia crista	--	--	+
Calotropis gigantea	+	+	--
Carissa opaca	+	+	--
Cassia angustifolia	+	+	--
Grewia rothii	--	+	--
Ipomoea carnea	+	+	--
Lantana camara	+	+	+
Vitex negundo	--	--	+
Ziziphus rotundifolia	+	+	+

Note: + indicating presence of the species whereas -- indicating absent of the species in collieries

families and site-III have 3 family only (table 2). Family Fabaceae, Rhamnaceae and Verbenaceae seems to present in all the concerned study sites of collieries, whereas family Tiliaceae was found to be present in site-II only.

Table 2: Familywise distribution of shrub species in different sites of collieries

Species	Site-I	Site-II	Site-III	Overall
Apocynaceae	2	2	-	2
Convolvulaceae	1	1	-	1
Fabaceae	1	1	1	2
Rhamnaceae	1	1	1	1
Tiliaceae	-	1	-	1
Verbenaceae	1	1	2	2
Total	**6**	**7**	**4**	**9**

Herbaceous compostion

A wide variation was recorded in herbaceous species in the collieries sites of Kumda. A sum of 31 species across the sites were recorded. In the site-I a total of 16 herb species were recorded while in the site-II total 20 herb species were found and in the site-III a sum of 26 herbaceous species were recorded (table 3).

Table 3 : Occurance and distribution of herb species in different sites of collieries

Species	Site-I	Site-II	Site-III
Achyranthes aspera	+	+	+
Ageratum conyzoides	--	--	+
Alternanthera sessilis	--	--	+
Anisomeles indica	--	+	+
Apluda varia	+	--	--
Bidens pilosa	--	+	+

Cajanus scarabaeoides	--	--	+
Cassia tora	+	+	+
Crotalaria juncea	+	+	--
Cynodon dactylon	+	+	+
Cyperus compressus	--	--	+
Cyperus rotundus	+	+	+
Desmodium pulchellum	--	+	--
Desmodium triflorum	+	+	+
Eragrostis diarrhena	--	--	+
Euphorbia hirta	+	--	--
Evolvulus nummularius	+	+	+
Fimbritylis dichotoma	--	--	+
Hemidesmus indicus	+	+	+
Malvastrum coromandelianum	+	+	+
Oplismenus burmannii	--	+	+
Parthenium hysterophorus	--	--	+
Phyllanthus niruri	+	+	+
Rumex dentatus	--	+	+
Saccharum spontaneum	+	+	+
Setaria glauca	+	+	+
Sida acuta	+	+	+
Themeda quadrivalvis	--	--	+
Tridex procumbence	+	+	+
Vigna pilosa	--	--	+
Xanthium strumarium	--	+	--

Note: + indicating presence of the species whereas -- indicating absent of the species in collieries

The familywise distribution of herbaceous species is presented in the table 4. In the site-I a total of 16 species were recorded of which 25% species were distributed under the Poaceae family. The family Lamiaceae and Polygonaceae were totally absent in the site-I as compare to site-II and site-III. Similarly, Poaceae family was found to be most dominant in the site-II and site-III.

Table 4 : Family wise distribution of herb species in different sites of collieries

Species	Site-I	Site-II	Site-III	Overall
Amaranthaceae	1	1	2	2
Asclepiadaceae	1	1	1	1
Asteraceae	1	3	4	5
Caesalpiniaceae	1	1	1	1
Convolvulaceae	1	1	1	1
Cyperaceae	1	1	3	3
Euphorbiaceae	2	1	1	2
Fabaceae	2	3	3	5

Lamiaceae	-	1	1	1
Malvaceae	2	2	2	2
Poaceae	4	4	6	7
Polygonaceae	-	1	1	1
Total	**16**	**20**	**26**	**31**

The environmental impact of coal mining has considerable issues and impacts such as land use, deforestation, over-burden, waste management, water, air and noise pollution caused by mining operations. It was found that there are many opencast and underground mining centers located in and around of the collieries of Bishrampur. Due to intensive mining activity, a large area of forest has been felled for mining purposes. The present study reveals substantial number of herb and shrub species as well as population in the concerned study sites of collieries. Many changes due to disturbance are directly related to alteration in vegetation characteristics and dynamics, these features may be allied on forest type, site conditions, local weather and other anthropogenic factors and its regimes (Jhariya *et al*., 2012, 2013, 2014 & 2016; Jhariya and Yadav, 2016). Mining cause huge impact on the the site conditions which facilitate very limiting and poor environmental condition for the vegetation establishment, their growth, regeneration, colonization and development over a given landscape which influenced by mining operations. Under such circumstances understory species, especially shrubs and herbs get opportunity to grow, invade, colonize, and more suitable environment for understory vegetation due to openness of canopy which increase the light and resource avilability and less competition due to negligible presence of upperstory or tree stratum. Mining activities not only reduces the diversity and abundance of vegetation but also reduces the plant productivity and encourages to invasion of unwanted or uneconomically important species (Jhariya et al., 2013).

Present results on herbaceous species were comparable with Sinha et al. (2015), they reported a total of 27 herb species distributing among 15 families with a density of 776000 individuals ha^{-1} for Khairbar plantation (Sal) site in Sarguja district. Jhariya *et al*. (2013) reported that the density of herbs across various sites ranged from 502000-724000 individuals ha^{-1} in Rowghat mining area of Narayanpur district (C.G.). Across all the sites *Seteria* sp. was recognized as dominant species. The maximum numbers of species (15) were recorded in Godenmar Dongri and Bedhiyar Nala followed by Parmad Dongri (14), Anjrel, Tarhur and Bhusujkun Dongri (12). The higher occurence may due to open canopy, resource avialability, site conditions, low competition etc. It is also reported that plants may facilitate other plants directly by ameliorating harsh environmental conditions or increasing the availability of a resource (Joshi and Bharti, 2005).

Sobuj and Rahman (2011) reported that a total 15 shrubs, 21 herbs in the natural forest, on the contrary 8 shrubs and 12 herbs species were identified in plantation forest. Oraon et al. (2015) reported that natural regeneration potential of shrubs was more in anthropogenically disturbed site as compared to undisturbed site. Furthermore, they reported a sum of 4-9,

4-12 and 3-10 species of shrubs were found on heavily, moderately and lightly disturbed site, respectively which comparable with present estimated values for shrub strata. Oraon *et al*. (2014) worked on variation in herbaceous composition following anthropogenically disturbed environment in tropics and reported that the 33-39 herb species were found across the circle of Bhoramdeo sanctuary area of Kawardha. Rahman *et al*. (2010) reported that shrubs constitute 10 species, herbs 9 species and vines 3 species, respectively in the concerned sites during the study.

Conclusion

It revealed from the study that mining activities in Kumda collieries has influenced the flora and soil biota at countless magnitude due to overdumping. The site-I has found to be more degraded and have less floral diversity in terms of speceis presence, their orrucrance and distribution over the concerned collieries. The restoration of mining landscape can be achieved by plantation practice, which can be further improving the growing environment for the vegetation. Restoration of collieries often entails amelioration of physical, biological and chemical characteristics of substrate and ensuring the return of vegetation cover. Overburden/Dumping in the collieries results in the burrying of seeds and rhizomes or other reproductive parts which considered as the natural seed bank. Since, soil is considered as a huge natural seed bank, it is important to handle these resources correctly, which in turn may successfully recover disturbed area by natural regeneration after the commencement of favourable environment. Proper management implications should be applied for the betterment of the collieties. A comprehensive strategy, regular monitoring, appropriate action plant and regulations are needed to alleviate the devastating impacts of the mining upon ecology and environment and its functioning.

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Diversity of *Amylosporus campbellii* in central India

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Introduction

India is one of the 12 mega biodiversity regions of the world. Indian forests types include tropical evergreens, tropical deciduous, swamps, mangroves, sub-tropical, scrub, sub-alpine and alpine forests. These forests support a variety of ecosystems with diverse flora and fauna. Fungi of various types normally inhabit the different parts of plant body such as root, stem and leaves. Some of these may be harmless saprophytes while other may be weak or dangerous pathogens. A good number of these fungi produce large and conspicuous fruit bodies and therefore called as macrofungi. These macrofungi generally belongs to two orders, *Aphyllophorales* and *Agaricales*, of the class Basidiomycetes while a few are Ascomycetes. Many of these macrofungi cause plant disease and wood decay which are responsible to the great economical loss in forestry as well as destruction of stored wood logs and wood products in common use. Fungi are the most diverse group evolved parallel to plants and animals involve in several ecological services like organic matter decomposition, biogeochemical cycles and symbiotic association. They are capable to occupy and flourish in a variety of ecological niches due to their diversity, distribution, dissemination and adaptability. Although various estimates of fungi range between 0.5 and 9.9 million species, currently 1.5 - 3 million species has been accepted based on the plant-fungus ratio in different geographical regions (Cannon 1997, May 2000, Hawksworth 2001, 2012, Mueller & Schmit 2007). However, the recent fungal community analysis by molecular methods gave an estimate of 5.1 million species, which stands as median value of previous conventional range (0.5-9.9 million) (O'Brien et al. 2005). Now-a-days, macrofungal investigations are gaining tremendous importance owing to the economic benefits especially nutritional and bioactive potential (De Silva et al. 2013, Manna & Roy 2014). Estimated total macrofungi represents about 56,700 species worldwide and up to 850 species are known mainly from the Himalaya and Western Ghats of India (Manoharachary et al. 2006, Mueller et al. 2007). Madhya Pradesh is "Central Province" and is located in the geographic heart of India and between latitude 21.2°N-26.87°N and longitude 74°02'-82°49' E. The state straddles the Narmada River, which runs east and west between the Vindhya and Satpura ranges; these ranges and the Narmada are the traditional boundary between the north and south of India.

In the present study one macro-fungus, *Amylosporus campbellii* associated with *Tectona grandis* causing butt rot is for the first time reported on teak from central India.

Materials and methods

Collection of samples

The fungus was collected during month of September, 2012 from Tropical Forest Research Institute (23º5' 37" to 23º6' 37"N latitude and 79º59'49" to 79º59'42"E

longitude) campus, Jabalpur, Madhya Pradesh. All the relevant information regarding collected fungal fruiting bodies the habit and habitat, color, texture, size and size, hymenial configuration zonations etc. were recorded at collection spot. Fungal fruit body was deposited in the herbarium of Forest Pathology Division, TFRI, Jabalpur.

Identification of fungus

Identification of fungal fruit body has done with help of relevant literature (Bakshi 1971, Ryvarden and Johansen 1980, Roy and De 1996, Verma et al. 2008, Tiwari et al. 2013) and internet

Results

***Amylosporus campbellii* (Berk.) Ryvarden (Figure 1-3)**

Scientific classification:

Kingdom: Fungi
Phylum: Basidiomycotina
Class: Agaricomycetes
Order: Russulales
Family: Bondarzewiaceae
Genus: *Amylosporus*
Species epithet: *campbellii*

Synonymy:

=*Amylosporus graminicola* (Murrill) Ryvarden, (1973)
=*Polyporus anthelminticus* Berk, (1866)
=*Polyporus campbellii* Berk, *Hooker's* (1854)
=*Polyporus graminicola* (Murrill) Murrill, (1915)
=*Polyporus mollitextus* Lloyd, (1919)
=*Polyporus popanoides* Cooke, (1881)
=*Polyporus propinquus* Lloyd, (1922)
=*Polyporus tisdalei* Murrill, (1943)
=*Scutiger tisdalei* Murrill, (1943)
=*Tyromyces graminicola* Murrill, (1915)
=*Wrightoporia campbellii* (Berk.) (1992)

Taxonomic description

Fuitbody, annual, pileate, laterally stipitate, fan shaped, fleshy and more or less watery when fresh, becomes spongy, brittle and light in weight on drying, 70-120 x 100-140 x 10-25mm. Pileus: semicircular, velutinate, soft to touch, whitish with pink tint towards the base when fresh drying buff to ochraceous, azonate, uneven, smooth. Margin: whitish to cream, entire, thick. Context: white to ochraceous homogeneous, soft, 15 mm thick towards base. Hymenium: creamish white to ochraceous-buff, poroid, pores 2-4/mm, round to angular. Hyphal system: dimitic, generative hyphae with wide lumen, thick walled, 1.5-3.0 µm wide, hyaline, mostly with simple septa, thin walled, 3.0-5.0µm wide, skeletal hyphae pale golden yellow, unbranched, gleoporus hyphae mostly confined to the context almost hyaline to yellowish with an oily to granular content 3.0-5.5 µm wide. Basidia: hyaline, clavate, with a basal clamp and four sterigmata, 13.0-16.5x4.0-8.5µm. Basidiospore: ellipsoid to ovoid, thin-walled, smooth, with very fine warts, 4.5-5.5 x 3-4 µm.

Collection examined

On *Tectona grandis* (teak) butt region, TFRI campus, Jabalpur, September 10, 2012, collected by C.K. Tiwari, R.K. Verma and Jagrati Parihar. Fungal Herbarium specimens number TF- 2799.

Other known hosts

Dendrocalamus strictus

Fig. 1: *Amylosporus campbellii*, habit, fruitbody showing pileus

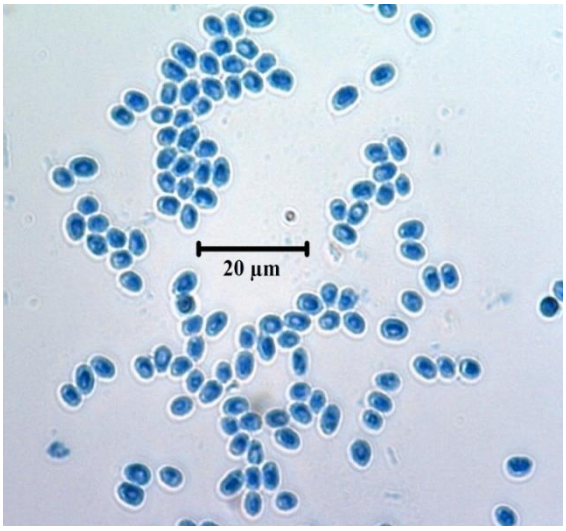

Fig. 2: *Amylosporus campbellii*, basidiospores

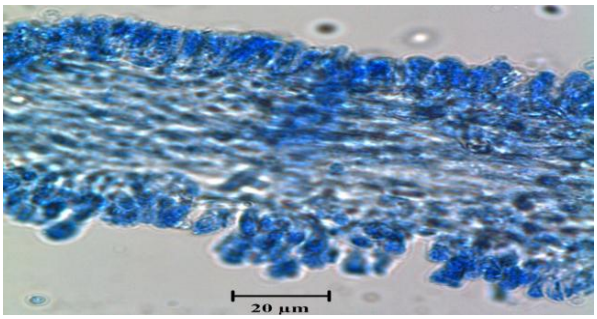

Fig. 3: *Amylosporus campbellii*, basidia with hymenium

Distribution

Widely spread in subtropics and tropics specimen recorded from USA, Jamaica, Bermuda, West Indies, Brazil, Venezuela, Nigeria, Kenya, Tanzania, Pakistan, India and Srilanka.

Discussion

Amylosporus campbellii has worldwide distribution. It was recorded as wood-decaying fungi from southern China (Dai *et al.* 2003, 2004a, 2004b). In the course of a study of polypores from Hainan Island, a huge polypore, identified as *Amylosporus campbellii* (Berk.) Ryvarden, was found on grassland. It was reported as new to the Chinese fungal flora and the first record from Southeast Asia. A detailed description of the fungus was based on field observations and microscopic examinations. *Amylosporus campbellii* was also reported from tropical Africa and America (Ryvarden and Johansen 1980, David and Rajchenberg 1985, Gilbertson and Ryvarden 1987, Roy and De 1996). This is the first report of occurrence of *Amylosporus campbellii* on teak. Basidiospores of the species were reported to be ellipsoid (4.5–5.5 × 2.5–4 µm, Gilbertson and Ryvarden 1987) or broadly ellipsoid to ovoid (4–5 × 2.5–4 µm, Ryvarden and Johansen 1980), while they are broadly ellipsoid to oblong-ellipsoid based on our study.

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Gender significance in forestry and agroforestry

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Introduction

India is primarily an agricultural country and our people have toiled in lands for our better prosperous future. The hard work and effort are taken by both men and women without any gender discrimination. So it can be rightly said as the women empowerment was made in the field of agriculture. Eventhough they face many catastrophes' as their in most cultures use and access rightsland, trees, water, and animalare often differentiated along gender lines. In manysocieties, women have fewer ownership rights than men (Agarwal, 2010). Although women may frequently possess de facto or land use rights (compared to men's de jure rights), women's access rights are often mediated by their relationships with men, such as through marriage, divorce, or widowhood (Hecht, 2007; Mwangi*et* al., 2011), yet women's role is very vital which cannot be neglected.

The Beijing Declaration and Platform for Action was a declaration on the Fourth World Conference on Women: Action for Equality, Development and Peace which was part of initiative under UN banner forgender equality as a human right, a condition for social justice, and a "necessary and fundamental prerequisite for equality, development, and peace." Beijing set its sights on removing all barriers for women's equal participation in public and private spheres. The past twenty years after the declaration has provided the opportunity for significant learning about how to do so, in a vast range of "spheres" (Bunch and Fried, 1996). This article provides a glance on the role of women in forestry sector.

Role of women in forestry

A large and growing body of evidence demonstratesthat women's involvement in forest management produces substantial gains for forest conservation and for livelihoods more generally (Agarwal 2010; Hecht, 2007; Mai et al., 2011).Normally, women do play a different role in different dimensions which has both positive and negative impact on them.

Positive effect on women

Food scenario

Early day men generally used to go for hunting and women are involved in the field of gathering. As time have changed men have changed their domain to either agriculture or others jobs for stable income to support their families but still women in the fringe and forest area are involved in the collection of NTFP'S(Cavendish, 2000; Shackleton et al., 2011). This have offered women a have substantial knowledge regarding the identification and preparation of nutritious forest foods to enhance the nutrition and health of their households (FAO, 2012). In addition, income generated from these activities by women can add significantly to their households' purchasing power.

Fodder for livestock

In many regions, women (and, often, children as well) play a crucial role in providing livestock with tree-based fodder, thereby contributing to domestic livestock production and sustaining draught animals for ploughing and producing manure. For instance, data from East African highlands

(Franzel and Wambugu, 2007) show that it is mostly women who plant and manage fodder shrubs. These activities support domestic livestock production, enhance milk and meat supply and contribute to higher household incomes. This is true in Indian scenario too for this is an important of source of income in the arid and semi-arid regions.

Value addition of NTFP'S

Activities along the forestry value chain tend to be differentiated along gender lines. Men are mostly engaged in planting, maintaining and harvesting trees for commercial purposes, while women mainly take care of products for subsistence use, such as food, medicines, fuel wood, fodder, and those for soil fertility improvement. One reason for this distribution of labour is that production of commercial forest products such as timber and charcoal requires physically taxing "technologies" (machetes, axes, saws) that are commonly regarded as a male domain. In addition, forested areas are often considered to be more unsafe for women than for men. Consequently, women can be pushed to shorten the time spent in the forest, which may in turn limit their options to those categories of forest products that can be quickly harvested and transported for processing at home, such as fuel wood, forest foods, medicine, resins and dyes which has provides them an opportunity in disguise.

Women empowerment examples

The gum karaya value chain in India in Gujarat, thousands of very poor women rely on gum karaya collection for their incomes. Most do not have collection licenses and are forced to sell at very low prices. An intervention by the Self Employed Women's Association (SEWA) helped female gum collectors to organize into groups. These groups secured collection licenses for their members and were able to negotiate higher selling prices with the Gujarat State Forest Development Corporation. Eventually, the women also won the right to sell on the open market after some value addition, where prices are higher (Carr, Chen and Jhabvala, 1994; SEWA, 2000).

When Nobel Peace Prize laureate Wangari Maathai turned her attention to the state of the environment in Kenya in 1977, she began with a tool that had been previously overlooked by conservationists. That tool was the power of women as agents of change. With the support of local Kenyan women, Maathai's Greenbelt Movement was revolutionary in forwarding two tightly intertwined issues: women's rights, and environmental conservation.

Constraints and negative impact on women

Fuel wood and household

Even though the usage of LPG is popularized in India yet there are women who still go for fuel wood collection. This collection is very indispensable for it has to happen as it is the only source of energy for them for cooking. This has got a very detrimental effect on the health condition of the women. This dimension needs a better focus for a sustainable future.

Participation in forest management insitutions

The literature suggests that although women's participation in forest management institutions, such as forest user groups (FUG), raises incomes and promotes resource sustainability, theyoverwhelmingly tend to be underrepresented in such groups (Agarwal, 2001; Das, 2011). The reasons for women's lack of involvement in organizations dealing with natural

resources managementmay be due to gender biases in technology access and dissemination, women's labor or skills constraints, or their lack ofsanctioning authority (Bandiaky-Badji, 2011; Lewark et al., 2011; Nuggehalli and Prokopy, 2009; Reed, 2010).

Conclusion

Gender-specific data on forestry are scarce, and the few country studies available are largely unsuitable for cross-country comparison. Sunderland et al. (2014) used a large multi-case dataset to test conventional assumptions about gender differences in forest product use. Overall, they found significant gender differentiation in the collection of forest products, which seems to confirm that men and women play distinctive roles in the forest sector. However, they also found that the gender patterns of forest use and management are much more nuanced than previously thought, with men playing more important and diverse roles in the contribution of forest products to rural livelihoods than often reported.

A key finding of the study is that regional differences are strong. The commonly held view that women are the main collectors of forest products holds true only in Africa. In Latin America, men contribute greater income shares from unprocessed forest products than women, while in Asia the contribution is roughly equal. This regional differentiation is consistent with previous analyses in which the marketing systems of forest products in Latin America have been described as "specialized", those in Asia as "diversified", and those in Africa as "subsistence-oriented". So it the need for to create a better market for goods and NTFP's form forestry there by we can achieve both women empowerment as well as increase the contribution of forestry towards GDP.

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Bridge between commerce and subsistence through *Borassus flabellifer* based agroforestry

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The genus *Borassus* is a widely distributed palm genera, having its range from eastern Indonesia and Papua New Guinea to western Africa and Madagascar. *Borassus flabellifer*, the Asian palmyra palmis native to the Indian subcontinent and Southeast Asia, including Nepal, India, Bangladesh, Sri Lanka, Cambodia, Laos, Burma, Thailand, Vietnam, Malaysia, Indonesia, Philippine and China. This palm is known for food, beverage, fiber and for numerous utilities for subsistence. In India, the cultivated populations of *Borassus flabellifer* (Linn.). are widespread in Kerala, Tamilnadu, Karnataka, Andhra Pradesh, Telangana, Maharashtra, Orissa, Madhya Pradesh, Bihar and West Bengal. Isolated patches are also seen in Assam, Gujarat and Uttar Pradesh. Inspite of its wide distribution and known ethno botanical uses, its economical contribution to farming community or national economy is below marginal or negligible as commercial exploitation of this Cinderella tree is never considered.

While world wine industry on the other hand is prosperous including all stakeholders i.e. industry and commercial wine yards. It was reported that world consumption of wine was 241.2 mhl in year 2012 worth of 25.7 billion Euros. However socio-economical and agro climatic situations of developing countries from African and Asian continents dose not permit poor farmers of small landholdings to reap benefits from the booming this industry.

I believe that toddy industry has a great potential to uplift socio-economic conditions and betterment of poor farming community, rural populace and national economy. From a commercial point of view the most important drawback of toddy as a alcoholic beverage is "Its lesser know and not considered before for commercial scale" and followed by some other small flaws such as lesser shelf-life, order, colour and essence which can be manipulated highly in current scenario of developed research and technology.

Henceforth this Cinderella species cab be explored in commercial point of view and also this industry can be a platform for young entrepreneurs. *Borassus flabellifer* should be promoted for large-scale plantation on farmlands boosting toddy palm based agroforestry for commercialization of toddy product and to raise this market as a challenge to international wine market. Large scale promotion of *Borassus flabellifer* for planting along agricultural crops in agroforestry models can be encouraged by institutionalizing buyback policies from various public and private channels in order to build trust between industry and farmers. This synchronization provides enhanced employment in farming sector as well as in industry for rural populace after imparting needed technical skills.

Arnebia benthamii (Wall.ex.G.Don) Johnston- a medicinally important plant

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Botanical Name
Arnebia benthamii (Wall. ex G. Don) Johnston
Synonym
Macrotomia benthamii DC.
Family
Boraginaceae
(Local name
Ratanjot, Laljari, Masreen
Part used
Roots
Chemical contents
A red dye, essential oil
Current market rate
₹ 55.00 per Kg.
Flowering and fruiting
June-August
Description
*Arnebia benthamii*a high-value Himalayan medicinal plant, ranks second in the list of medicinal plants prioritized for western Himalaya and also figures among the 59 medicinal plants prioritized for conservation due to high extinction threat.

It is an erect, hairy herb, with thick purple roots, herbaceous perennial, 30–90 cm in height, occurring in the alpine and subalpine Himalaya at altitude of 3000–3900 m asl. Stems solitary, fistular, un-branched and densely covered with white trichomes. Basal leaves many, lanceolate, entire acute, middle and upper cauline leaves gradually reduced in size upwards. Flowers purple to pink, in dense cylindrical, thyrsoid inflorescence. Flowering occurs in May. The flowers are hermaphrodite (have both male and female organs) and are pollinated by Insects. Bracts linear lanceolate, acuminate, exceeding the calyx. Calyx divided to the base. Corolla usually shorter than the calyx. Nutlets broadest near the middle, narrowed towards the base.

Distribution
The plant is suitable for light (sandy) soils, prefers well-drained soil and can grow in nutritionally poor soil. Suitable pH: acid, neutral and basic (alkaline) soils. It cannot grow in the shade. It prefers dry or moist soil. The plant is found from Pakistan to West-Nepal between 3300-4300 metres in open slopes and alpine pasture. In Himachal Pradesh the plant is found in Kinnaur, Spiti, Chamba, Chanshil, Chitkul, Upper Parvati valley, Rupi Bhabha WLS (Muling). In J&K this plant is found in Ladakh, Ducksum, Anantnag District., Wadwan (Doda), Erkichik in Kargil Dt., Gurez. In Uttaranchal this plant is found in Daurma, Byans,

Ralam, Milam, Harkidoon, Gangotri, Badrinath, and Kandara. In Himachal Pradesh, the plant has been collected from Thamsarjot of Bara Bhangal in Kangra and Jakha Kanda of Dodrakawar in Shimla district between 3500-4500 metres. The plant is also found in pin valley.

Propagation

Seed sowing is done in spring in a greenhouse. Germination usually takes place within 2-8 weeks at 20^0C. When large enough to handle, pick the seedlings out into individual pots and grow them in the greenhouse for their first winter. Plant out in late spring or early summer, after the last expected frosts. It is best to harvest the seed when it is slightly under ripe, since it is quickly dispersed when ripe. Root cuttings in sand in a frame during the winter.

Cultivation of the plant

The plant can be cultivated in open slopes and shruberries at 3000-4300 metres.

Properties and uses

The species is a major ingredient of the commercial drug available under the name Gaozaban, which has antibacterial, antifungal, anti-inflammatory, and wound-healing properties. The roots yield a red pigment, Shikonin (a dye), which has several medicinal properties and is marketed under the trade name Ratanjot. The species also possess stimulant, tonic, diuretic and expectorant properties. Aqueous extracts, syrup, (Sharbat) and jam prepared from the flowering shoots are considered useful in diseases of the tongue, throat and is also useful in fever. Root is frequently used as an antiseptic and antibiotic in healing of the wounds when applied as a poultice and also for subsiding swellings of the organs. Its paste made in water is applied to fire-burns and is a quick healer.

Preparations

Used as a colouring matter for hair oils, foodstuffs and silk. Also used in many ayurvedic formulations.

Mahogany (*Swietenia macrophylla* King): a suitable timber species for agroforestry

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Abstract

Swieteniamacrophylla (Family- Meliaceae) is promising important timber species for agroforestry due to less competition of root due to deeper rooting nature, multipurpose tree, moderate fast growth, adoptability, remarkable wood qualities, better form and higher sown out turn, amenability to stand management practices etc. are some of the features that endear among the tree farmers.In addition, mahogany stand management practices such as fertilizer dosage, pruning and thinning practiced before sapling stage gives better result than untreated stand.

Key words: Mahogany, wood properties, *Swieteniamacrophylla*, propagation and Agroforestry.

Introduction

Climate change has been continuing process and it will be change in thecoming years at unpredicted rates since the human civilization. Indeed, it still doubt and unclear concept to measure exactly relationship between tropical forest and global climate change, howeverit has predicted that evaporation andprecipitation will increase in someregions, whereas other regions willbecome drier by the end of thepresent century (Innes, 2005).Tree species have to represent long rotation period and due to economic value, timber quality, invaluable contribution in regulating atmospheric CO_2 emission (above and below ground carbon (Dixon et al., 1994)) and atmospheric carbon sequestration through tree planting is the only currently eligible land use change activity for developing countries within the Clean Development Mechanism (CDM) of the United Nations Framework Convention on Climate Change (UNFCCC) to mitigating climate change (IPCC, 2007).It is generally recognized that temperature increases and altered patterns of rainfall, as well as extreme events, will have an influence on livelihoods and the sustainable use of natural resources and management strategies. At the same time, increasing access to energy in both cost-effective and climate-friendly ways is a major challenge for many developing countries. Traditional multifunctional agroforestry systems, land-use approach that integrates multipurpose trees with crop production also addresses environmental degradation in tropical region offer innumerable ecological benefits such as carbon sequestration, mitigation of climate change, enhancing soil fertility and water use efficiency, biodiversity conservation, biological pest control, sustainable land use, shelterbelt and windbreaks, microclimate amelioration,

breaking the poverty and food insecurity circle, caveats and clarifications (Kumar, 2016). Sustainable forest management through agroforestry could help mitigate climate change, but not without the empowerment of local communities who are also in a key position to protect and conserve their source of living (Wamuku, 2012).

Distribution

Mahogany (*Swieteniamacrophylla*) (Family-Meliaceae and native of Central America) is one of the best quality timbers for high class furniture and cabinet work due to its light hardwood quality in the world. On the other hand, mahogany is the most important timber tree in neo-tropical forests, has become the flagship species in debates about the feasibility of sustainable tropical forest management (Gullison et al., 1996). *S. macrophylla* is the most widespread species occupying principally the Atlantic regions of South Eastern Mexico, Central and South America, Philippines, Sri Lanka, Solomon Island, Fiji, Martinique and Western Somoa. In India, mahogany has established in 1795, when it introduced from West Indies to Royal Botanical Garden, Culcutta (Troup, 1921) while *S. macrophylla* and *S. mahagony* was initited in South Malabar in 1872. Mahogany species is planted at Edacode, North Forest Division, Kerala in 1893, it has regarded as an exotic species, planted in scattered small plantations and nowadays, mahogany grown a wide acceptance among the tree growers in Keraladue to its economic importance of timber, moderate growth, adoptability, remarkable wood qualities, better form and higher sown out turn, amenability to stand management practices etc. aresome of the features that endear among the tree farmers.Indeed, two relatives of *S. macrophylla*, *S. mahogany* and *S. humilis*, are presently listed in Appendix II of the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES) (Rodan et al., 1992).Nowadays, increasing pressure to add *S. macrophylla* to CITES,Appendix II. This would mean that *S. macrophylla* could only enter international markets after the government of the producer country had determined that trade would not lead to significant population reductions of this species. It is also known as green gold, Honduran mahogany, Honduras mahogany, Big leaf Mahogany, Valia Mahogany and Mahogany.

Phenology

Evergreen tree with well shape crown (Fig. 1) and the leaves unipinnate, paripinnate; leaflets 3-4, falcately lanceolate, very oblique at base, acute, glabrous, shinning above, paler beneath; secondary nerves 6-12 on each side. Flowers nice smelling, in narrow, supra-axillary panicles. Panicles shorter than leaves, glabrous. Sepals distinct, ovate, minute. Petal greenish-white, oblong. Staminal tube apically 10-lobed, urceolate. Disk red, annular. Ovary 5-locular, with many ovules; almost distinct, ovate-oblong, minute, ciliolate.

Ecology

Swietenia macrophylla seedlings have been observed to survive for some time beneath a closed forest canopy. Similar observation observed that partial shade during early stage of seedling gives more vegetative growth compare to open area (Kumar et al.,

2015). Indeed, in forests subject to a pronounced dry season, seedling survival may be enhanced by the lower temperatures

Figure 1. Mahogany plantation. **A.** Quincunx or Diamond pattern; **B.** Square planting pattern; **C.** Bed preparation for intercropping in Horti-silvicultural system; **D.** Tree Pruning of mahogany tree in India; **E.** Tree Pruning / Spraying in plantation orchard in foreign country and **F.** Thinning practice along with estimation of biomass and carbon sequestration.

and higher soil water potential. Mahogany is distributed in elevations range from 50 to 1400 m with annual precipitation 1500 to 4000 mm, temperatures of 23 to 36 ^{0}C and can grow in diverse type of soils especially in under medium to heavy textured soils with free drainage.

Propagation

Capsules are dehisced and seeds are transported in closed containers maintain cool above 2 ^{0}C. Quality planting stock production is of paramount importance in any tree planting programmes because tropical seeds have generally a low viability

if they are not collected at the right stage. Seed is orthodox in nature in and possess intermediate seed storage behavior and the seeds viability could be maintain up to 24 month in polyethene bags at 10 ^{0}C. Kumar et al. (2015) found that mature mahogany seeds are hypogeal and treated with 100 ppm benzyl adenine (BA) for 12 hrs. could gave about 82.33% germination.Generally, under good growing conditions mahogany starts producing seed at 12 years old.Seed has been medicinal and pharmacological activity such as anti-inflammatory activity and also reported that it contains triterpenoids possessing anti-platelet activity and limonoids possessing anti-microbial activity (Ekimoto et al., 1991; Rahman et al., 2009).

Research work

We did small experiment on structure of mahogany fruit and measured physical parameters. The fruit of mahogany were selected in bulk from different locations in Thrissur district, Kerala during 2015-16. The study was carried out at Department of Silviculture and Agroforestry, College of Forestry, Kerala Agricultural University, Thrissur. Immediately after collection of fruits of mahogany transferred to the laboratory in double-sealed polythene bags and measures weight and number of seed per fruit were recorded (from 10 fruits of each location). The seeds, fruits were split with the help of mechanical support and based on size (mean of longest diameter along the direction of the embryo axis and its orthogonal diameter) but always keep in mind that it has not affect on healthy seed. Hundred seeds from each location were randomly selected to record length, width and thickness of mahogany seed (with and without wings). The data resulted that the average fruit length was varied from 11.8 to 13.4 cm, fruit width was varied from 6.9-8.2 cm and fruit radius varied from 12.8 to 13.9 cm (Fig. 2). In addition to few other parameters also recorded for further study on seed germination based on seed size variation. For instance, the average seed length and width was recorded 1.5 to 1.9 mm and 0.3 to 0.6 mm, respectively. We also taken measurement of seed plus wings parameters viz., the average seeds plus wings length and width were varied from 6.2 to 7.5 mm and 1.9 to 2.8 mm, respectively (Fig. 2).

Pest and diseases

Low infestation by an unidentified caterpillar in fallen fruits. The shoot and fruit borer, *Hypsiphyla robusta* (West and East Africa, Indonesia, Australia, South East Asia (Entwistle, 1967) and India (Chacko et al, 2002)) and *H. grandella* (Zeller) (Florida, Central and Southern America except Chile) (Entwistle, 1967) are the major pests (Chacko et al, 2002). Roberts (1965) reported that *H. robusta* was impracticable in view of the continuous attack by this shoot borer in chemical control while the biological control of this shoot borer using parasites was not possible because of the low rate of parasitisation. It was concluded that the fungus is a promising pathogen for the biocontrol of this serious pest infesting *Toonaciliata* and *S. macrophylla* in India (Mishra, 1993). Species of Helminthosporium, Allernaria, Drechslera and Curvularia are important field fungi recorded on seeds (Chacko et al, 2002). Orthene, a systematic insecticide, has

Figure 2. Seed structure of Mahogany: **A.** Overall seed structure (**I.** Mature fruits; **II.** Carpel; **III.** Endocarp; **IV.** Winged seed); **B.** Leaves pattern of mahogany; **C.** Bark characteristics of mahogany; **D.** Mature fruits of mahogany and **E.** Measurement of seed physical parameters.

proved an effective chemical control of this pest (Mohandas, 2000).

Wood properties

The following extraordinary characteristics encounter in mahogany wood:

- *Excellent workability*. Mahogany is known for its cooperative nature and easy sanding and machining, with a Goldilocks-esque balance of density that's just hard enough but not too hard. When the grain is straight and consistent, there's not much that can go wrong.
- *Excellent stability:* Mahogany is equally known for its superb dimensional stability. Flat pieces will remain flat. In the midst of seasonal changes in humidity, mahogany exhibits minimal shrinkage and swelling (http://www.wood-database.com/).
- *Grain/Texture*: Grain can be straight, interlocked, irregular or wavy. Texture is medium and uniform, with moderate natural luster.
- *Decent rot resistance*: Varies from moderately durable to very durable depending on density and growing conditions of the tree (Older growth trees tend to produce darker, heavier, and more durable lumber than plantation-grown stock). Resistant to termites, but vulnerable to other insects.
- *Workability*: Typically very easy to work with tools: machines well. (With exception to sections with figured grain, which can tearout or

chip during machining.) Slight dulling of cutters can occur. Sands very easily. Turns, glues, stains, and finishes well.

- *Beautiful grain*: Mahogany can sometimes be rather plain and almost utilitarian, but on other pieces, it ascends to the heights of sophistication. What antique bombe chest would be complete without exquisite crotch mahogany veneer drawer fronts?

Conclusion

Thus, the study reveals that mahogany can be use as intercropping system due to deep rooting nature of the species. However, crops with limited root spread can be intercropped with mahogany under quincunx planting but with little wider spacing. Hence, mahogany can be use at intercropping system in the early stage (Kumar et al., 2016). Intercropping practices not only generate early economic returns to grower but also improving the degraded soil condition, reduce the soil erosion, maximum land use system (capturing nutrients from different soil layers) and also adding the substantial amount of organic matter. Evolving appropriate stand management strategies to enhance productivity and thereby reducing the long rotation period has been the basic challenge before the silviculturist. However, stand management practices such as fertilizer dosage in plantation stand more growth than untreated stand. Similar growth patternhas observed while applied the first thinning (removal of alternate row/column) at stand age of 7-8 years. In addition, it observed that sapling age of mahogany plantation has more chance to damage by high wind speed especially in wider density space in plantation (> 3.5 x 3.5 m) and interestingly, it seem to observe that somewhat poor growth of individual mahogany may be surprisingly by its neighboring healthy mahogany, eventhough stand is even aged. Mahogany is moderate fast growing species but in early stage its shows the faster among the slow grower species up to sapling stage.

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Tree diversity of tropics

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Tropics are word that denotes the region of Earth between 23.5 degrees north and 23.5 degrees south of the equator. This part of the planet is very rich and diverse biome. However, even within the tropics, ecosystem subdivisions can be made based on the length of the rainy and dry seasons. Across the broad tropical landscape the gradual transition from rain forest to dry forest to savanna is mostly a function of rainfall during the growing season, with rain forests receiving the most and savannas the least. This transition takes place as one moves north or south from the equator, where consistent rain supports tropical rain forests.

Research into the diversity of this biome has largely concentrated on species richness/number rather than equitability, or the number of individuals that comprise each species. Tropical rain forests are renowned for their high species numbers. One hectare of primary forest usually contains over 100 tree species with a girth exceeding 10 cm and the number can reach almost 500 (Valencia et al., 1994). By comparison, temperate deciduous broadleaved forest attains only 25–30 tree species per hectare, at best (Richards, 1996). Tropical rain forests have been revered as the most species-rich biome on Earth, harbouring over 50% of species on just 7% of the land area.

Year-round growth allows the trees of tropical rain forests to grow very large and thus accumulate a lot of biomass in the ecosystem. Since biomass is about 50 percent carbon, more biomass means more carbon in the forest. Rainforests have so much biomass and are so widespread that they store a lot of the world's carbon.

The high species richness of tropical forests has long been recognized, yet there remains substantial uncertainty regarding the actual number of tropical tree species. Despite decades of biological inventories worldwide, we still do not know how many species exist and how they are distributed. Although global patterns of estimated vascular plant species richness and distribution have become more clear. A greatest effort to quantify the total number of species was taken by a group consisting more than 170 from more than 100 institutes. The publication titled as "An estimate of the number of tropical tree species" published in PNAS (Proceeding of National Academy of Sciences of the United States of America).

The authors have took care to put a logical way for presenting the outcome of the study. A pantropical tree inventory database from closed canopy forests, consisting of 657,630 trees belonging to 11,371 species, a fitted value of Fisher's alpha and an approximate pantropical stem total thereby estimated the minimum number of tropical forest tree species to fall between ~40,000 and ~53,000, i.e., at the high end of previous estimates. Contrary to common assumption, the Indo-Pacific region was found to be as pecies-rich as the Neotropics, with both regions having a minimum of ~19,000–25,000 tree species. Continental Africa is relatively depauperate with a minimum of ~4,500 – 6,000 tree species. Very few

species are shared among the African, American, and the Indo-Pacific regions.

Significance

The study of this sort help us to to learn that robust estimates of the number of tropical tree species. The study also has revealed that how that there are at least 40,000, but possibly more than 53,000, tree species in the tropics, in contrast to only 124 across temperate Europe. Almost all tropical tree species are restricted to their respective continents, and the Indo-Pacific region appears to be as species-rich as tropical America, with each of these two regions being almost five times as rich in tree species as African tropical forests

Conclusion

Explaining tropical rain forest species diversity remains a complex issue. Permanent plots and Long term research are now giving direct insights rather than inferences being made from observation of distribution patterns. Direct monitoring of processes may prove helpful in unravelling the relative importance of contemporary theories, particularly those that require dynamic meta-population studies.

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Wild Silkworm, *Attacus atlas* Linnaeus (Lepidoptera: Saturniidae)

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Abstract

Attacus atlas Linn. is a wild silk worm in India. This moth ranks as the world's largest moth when measured according to the surface area covered by its wings. Its sustainable management, conservation and exploitation in silk production are essential component of *Vanya* silk technology development in India.

Introduction

India is the natural abode of a large number of sericigenous insects, which produces different types of silk (Sengupta, 1985). Sericigenous insect have been an object of research since many centuries as they produce commercial silk. There are over 1500 sericigenous species belonging to the family Saturniidae. More than 160 species of wild silkworms have so far been recorded (Saratchandra, 2003). The humid and dense forests of India are most suitable habitat for large number of wild silk producing insects. *Attacus atlas* Linnaeus (Lepidoptera: Saturniidae). is a wild silkmoth popularly known as "Atlas Moth" or Deo Muga or Kotkari muga in Assam. It is widely distributed in south eastern Asia, and abundantly found in India and Indian Ocean Archipelago. The genus *Attacus* comprises of 15 known species. Out of this only one species, namely *Attacus atlas* is known to occur in India. The silk is secreted as broken strands having greater durability and used to make fine decorations in fabrics

A. atlas is the largest when measured according to the surface area covered by its wings. Peigler (1989) has reported over 100 plant species belonging to 90 genera in 48 families serve as host plants of *A. atlas*.

Moth of *Attacus atlas*
Source: Singh (2016)

Murphy (1990) for the first time has reported the presence of *A. atlas* in mangrove habitats, stating that it occurred on *Avicennia alba* (family Avicenniaceae) and *Bruguiera gymnorhiza* (family Rhizophoraceae). The biology of *A. atlas* has been studied by Saikia and Handique (1998) and Sathe and Kavane ((2014). The present article deals with the morphology of *A. atlas*, a wild silkworm of India.

Morphology of larva

This wild silkworm is found throughout India, Sri Lanka and Myanmar. Hampson (1892) has mentioned that larvae of *A. atlas* are pale green with brownish speckles, 1st, 2nd and 3rd somites with dorsal prominences, 4th to 11th somites with long fleshy dorsal and subdorsal blue-green spines projecting backwards, a series of lateral blue-black spines on 1st to 5th somites, a similar subdorsal series from 1st to 11th somites, both these series projecting forwards, an oval red ring on anal somite

above the claspers. Cocoons are pale grayish brown and pyriform. Jolly et al. (1977) have reported grayish brown colour cocoon of *A. atlas*.

Morphology of moth

According to Hampson (1892), the diagnostic features of moths are as follows:

head, thorax and abdomen red-brown, the basal segment and abdomen pale and each segment with a pale fringe, legs brown, fore wing with the costa brown, the basal area brown and red-brown edged by red, pale, and black lines, curved from the costa to vein 2, then oblique to near base of inner margin, medial-area red-brown, a large triangular hyaline spot at end of cell with a black edge, one or two hyaline streaks above it touching the post-medial line, which is black, pale and red and curved inwards from the subcostal to vein 2, then onwards to inner margin, outer area shading from pink through purplish fuscous to tawny brown, apical area yellow shading to pink, the membrane below the costa crimped and suffused outwardly with blue-grey and ending in a black spot, a dark red streak below vein 8, a yellow-brown marginal band with a highly waved black line on it, hind wing similar to fore wing, the ante medial line nearly straight, no streak above the hyaline triangular mark, the post medial line angled towards inner margin but not curved, apical area not variegated, a series of black spots within the black submarginal line which is less waved. Wing expense is 224 mm in case of male, whereas in case of female it is 250 mm.

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Know Your Biodiversity

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Crataeva religiosa

Crataeva religiosa is a large tree found in tropical zones either wild or cultivated. It belongs to order Brassicales family Capparidaceae and commonly known as Holy Garter Pear, Sacred garlic pear, Temple plant, barna, kumara kumaraka. The generic name '*Crataeva'* is given in the honor of Crataevus, a Greek botanist, who was living in the time of Hippocrates and the specific name '*religiosa'* indicates its growth near the places of worship. This tree is also known as spider tree because of spidery stamens.

It is globally distributed in the areas of India, Myanmar, China, Tropical Africa, Sri Lanka, Tonkin, Formosa, Malaya Archipelago and Polynesia. It is common throughout India and found mostly along the bank of river, streams and near the temples. It is also cultivated in gardens for its ornamental and medicinal properties.

It is a moderate-sized, much-branched deciduous tree having lenticels on branches. Bark is grey, smooth, with horizontal wrinkles. Leaves are trifoliate, petiole 4-15 cm long and petiolules are 5-8 mm long. Flowers vary in size between 3-7.5 cm in diameter, creamy-white, in solitary, axillary terminal corymbs, appears before the leaves. Pedicels are 2.5-5 cm long. Sepals are 4 in number. Petals are also 4 in number, long-clawed, 2-3.5 cm long, ovate and acute. Disk is lobed, hemispherical. Stamens are numerous, free, longer than petals, inserted on the margin of the disk. Ovary is ovoid on 3.5 cm long gynophores, ovules are many in number and stigma is sessile. Fruits are globose or ovoid, 2.5-5 cm in diameter, rind woody, smooth red when ripe, many seeded. Seeds are reniform, embedded in yellow pulp. Flowering and fruiting period is December-May.

It is used in Indian Ayurvedic medicines. It has anti inflammatory, diuretic, lithontropic, demulcent and tonic properties. Bark yields ceryl alcohol, friedelin, lupeol, betulinic acid and diosgenin. Root and Bark promote appetite and increase the secretion of bile juice. Root extract mixed with honey is good for scrofulous enlargements of the glands of lower jaw. Root bark is counter irritant. Stem-bark is hot, bitter at first and then sweet sharp, they are easy to digest, stomachic, laxative, antiperiodic, tonic, antihelmintic, useful in diseases of the chest and the blood and other urinary affections, pain and burning micturition. The plants also promote appetite. It is also used as a contraceptive. Juice is also given to women after childbirth.

Bark contains tannin for tanning. Leaves are stomachic and juice of leaves mixed with coconut milk and butter is given

internally in rheumatism. Flowers are astringent. Fruits are sweet, edible, oily, laxative, useful in 'vata', 'pitta' and 'kapha' and high in vitamin C. The nectar-filled flowers are attractive to a multitude of insects and birds. Fruits of this tree are used as spice because of its garlic taste. The juice of fruit, leaves and bark is applied to cure snakebite, infected wounds and cuts. Wood is used for combs, matchsticks and other small articles.

The tree is sacred and leaves are used to worship Lord Shiva especially on Mahashivaratri. The tree is also used to worship Rahu, one of the nine planets or the navagrahas. A postal stamp was also issued by the Indian Postal Department to commemorate this tree. Despite its usefulness, less attention has been paid to its floral biology, breeding systems and pollination mechanism. These are essential for the conservation, improvement and establishment of cultivation to increase the frequency of occurrence of this species. Keeping these facts in view, we need to conserve *Crataeva religiosa* trees before it will be counted under endangered species category.

Apteryx australis

Apteryx australis commonly known as Kiwi or kiwis are flightless birds native to New Zealand. It belongs to order Apterygiformes and family Apterygidae. Generic name '*Apteryx'* means 'without wings' and '*australis'* means 'sound wind'. Kiwi is smallest living flightless bird and lay the largest egg in relation to their body size of any species of bird in the world. The kiwi is also known national symbol for New Zealand, and the bird is prominent in the coat of arms, crests and badges of many New Zealand cities, clubs and organization.

The southern brown kiwi, Tokoeka, or Common kiwi, *Apteryx australis* is a relatively common species of kiwi, known from south and west parts of the South Island that occurs at most elevations. It is approximately the size of the great spotted kiwi and but its plumage is lighter in colour. Like all the other flightless birds, they have no keel on the sternum to anchor wing muscles. The vestigial wings are so small that they are invisible under the bristly, hair-like, two-branched feathers. Like most other ratites, they have no uropygial glands. Their bill is long, pliable and sensitive to touch. Their feathers lack barbules and aftershafts. They have 13 flight feathers, no tail and a small pygostyle. Their gizzard is weak and their caecum is long and narrow.

Kiwi is shy and usually nocturnal. They prefer subtropical and temperate and beech forests. Kiwis have a highly developed sense of smell and are the only birds with nostrils at the end of their long beaks. Kiwi eats small invertebrates, seeds and worms. They also may eat fruit, small crayfish, eels and amphibians. Because of the presence of nostrils at the end of long beaks kiwi can locate insects and worms underground without seeing or feeling them.

Kiwi is monogamous and the mating season is June to March. They are unusual among other birds in that, along with some raptors, they have a functioning pair of ovaries. (In most birds and

in platypuses, the right ovary never matures, so that only the left is functional.) Kiwi eggs can weigh up to one-quarter the weight of the female. Usually, only one egg is laid per season. The kiwi lays the biggest egg in proportion to its size of any bird in the world, so even though the kiwi is about the size of a domestic chicken, it is able to lay eggs that are about six times the size of a chicken's egg. The eggs are smooth in texture, and are ivory or greenish white. Producing the huge egg places significant physiological stress on the female. For the thirty days it takes to grow the fully developed egg, the female must eat three times her normal amount of food.

It is given status 'Vulnerable' in IUCN Red list category. At present, the greatest threat to their survival is predation by mammalian predators namely stoats, dogs, ferrets, and cats. Other threats include habitat modification/loss and motor vehicle strike. The restricted distribution and small size of some kiwi populations increases their vulnerability to inbreeding. Due to unmanaged kiwi, we are losing 2% of these birds every year that is around 20 per week. Thus, there is an urgent need to look on the management of these birds.

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