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Van Sangyan

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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
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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.)
A lichen is a self-supporting, symbiotic organism where fungal (mycobiont) and algal or cyanobacterial cells (photobiont) partners exist and function together. Recently, basidiomycetous yeasts were reported as additional components of lichens or as lichenicolous fungi. Lichens are cosmopolitan and equally able to colonize a variety of terrestrial habitats including those which are inhospitable for other organisms such as rock surfaces, the coldest alpine peaks and deserts. The primary Mycosphere photobiont, (green-algal or cyanobacterial) fixes carbon for both partners. The total number of lichenized fungi is still unknown, but different researchers predicted or estimated the number between 13,500 - 28,000 species. The Himalayan belt with a variety of terrestrial habitats is considered as a lichen rich landscape of Asia, comprising different forms of lichens (Upreti 1998). Lichen exploration and identification in Nepal is still poorly developed compared to higher plants, so more exploration and investigations are required to learn more about lichenized fungi. Proper understanding of the distribution and abundance of lichens will help in the preparation of a national Red list, crucial for the successful planning of nature conservation.

Lichens and bryophytes although relatively small in size form a significant component in many forest ecosystems. In addition to their large biomass and valuable role in ecosystem function (i.e. biogeochemical cycles) bryophytes and lichens represent a large portion of forest biodiversity. Several species of bryophytes and lichens (particularly epixylics; species growing on wood) are dependent upon old-growth forests for their survival. The conversion of a large proportion of the land base to second-growth forests may eventually result in the loss of these species. A better understanding of the patterns of bryophyte and lichen diversity, and of the relationship between sensitive species and their habitat, will provide useful information.

In line with the above this issue of Van Sangyan contains an article on Diversity and Distribution of Lichens in Tripura. There are other useful articles viz. Dalbergia lanceolaria L.f.: Prospect of a lesser known tree species in India, Prospective of lesser known tree species: Malabar orchid (Bauhinia malabarica Roxb.), Trees outside forest (TOF) in urban environment of Sarguja, Diversity of macro-fungi in Central India-XXII: Diversity of Laetiporus sulphureus in TFRI campus, the importance of the forest plants in eco-friendly-anti chemicals activity and their contribution in human welfare and हानिकारक खरपत्वारः प्रबंधन एवं नियंत्रण (in Hindi).

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

Looking forward to meet you all through forthcoming issues

Dr. R. K. Verma
Scientist ‘G’ & Chief Editor
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<td></td>
</tr>
</tbody>
</table>
Diversity and distribution of Lichens in Tripura

Poulami Saha¹, Sandeep Yadav², Pawan K Kaushik¹

¹Forest Research Centre for Livelihood Extension (FRC-LE)  
(Indian Council of Forestry Research & Education, Ministry of Environment, Forests and Climate Change, Govt. of India)  
Agartala  
²Forest Research Centre for Bamboo and Rattan (FRC-BR) Aizawl, Mizoram  
Email gpsahapoulami@gmail.com

Abstract  
Tripura is a landlocked small hilly state of north-eastern India and part of richest reservoir of biodiversity. Lichens are one of the excellent examples of symbiotic association, and a group of non vascular cryptogams. Lichens are not only a single organism; rather they are composite organism which comes into existence as a result of symbiosis between a mycobiont (fungus) and one or more phycobiont (cyanobacteria or green alga). Approximately 20,000 species of lichens are known from the world and India represents more than 10% of the species. Lichens are helpful for providing clean air to the adjoining cities but it also act as a safe haven for the species which cannot thrive in the urban environment. Lichenologically, Tripura along with north-eastern states of India is one of the richest zones in the country with abundance of many interesting taxa. They occur in all possible environmental habitats of the world, but are diverse in tropical regions. Lichens are valuable bio-indicators for evaluating the consequences of human activities that are increasingly changing the earth’s ecosystems. Different types of lichen specimens were randomly collected from rock, soil, twigs, leaves and barks of different trees from different forest types in Tripura. In Tripura tropical evergreen forest contributes the maximum numbers of lichen association. The rich lichen diversity in a small forest area indicates the need for more such exploration in the region.

Keywords  
Lichen diversity, Forest types, Tripura, Eastern Himalaya, North-east India

Introduction  
Lichens are the key component of forest biodiversity. Lichens, are the symbiotic associations between mycobiontic and photobiontic partners, occur on a wide range of substrates in most terrestrial ecosystems of the world, including the bark of trees (corticolous lichens), soil (terricolous lichens), rocks (saxicolous lichens) and deadwood (lignicolous lichens). Lichen diversity plays an important role in ecosystem function. The state of Tripura, with a geographical area of 10,491 sq km (4,051 sq mi) is predominantly hilly and is surrounded on three sides by a deltaic basin of Bangladesh. The state is situated between 22°57’ and 24°32’N and 91°10’ and 92°20’E with tropic of cancer passing through it. The State is situated in the south-western extremity of North-East region of the country. It shares border (1001 km in perimeter) with Bangladesh, Assam and Mizoram. International border with Bangladesh is 856 km, which is almost completely open and porous. The State has six forest types (Table 1) as per Champion and Seth Classification system (1968). The proposed transmission lines shall pass through following districts having forest cover of 80.93 percentages.
The forests in the state are mainly tropical evergreen, semi-evergreen, and moist deciduous. Total Forest area of the state is 6294.287 sqkm and 60.02 percentage areas are covered geographically to forest land.

**Table 1: Forest types**
According to classification of Champion and Seth (1968), the forests of the state have been classified in the following six types:

<table>
<thead>
<tr>
<th>Sl. No.</th>
<th>Types of forests</th>
<th>Code</th>
<th>Area in km²</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>East Himalayan Lower Bhabar Sal</td>
<td>I/I/3/3C/CIb</td>
<td>87.77</td>
</tr>
<tr>
<td>2</td>
<td>Cachar Tropical Evergreen Forests</td>
<td>I/I/IB/C3</td>
<td>150.94</td>
</tr>
<tr>
<td>3</td>
<td>Moist Mixed Deciduous Forests</td>
<td>I/I/3/3C/C3</td>
<td>550.28</td>
</tr>
<tr>
<td>4</td>
<td>Low Alluvial Savannah Woodland</td>
<td>I/I/3/3C/II</td>
<td>1316.82</td>
</tr>
<tr>
<td>5</td>
<td>Moist Mixed Deciduous Forests / Dry Bamboo Brakes</td>
<td>I/I/3C/2SI</td>
<td>1230.04</td>
</tr>
<tr>
<td>6</td>
<td>Secondary Moist Bamboo Brakes</td>
<td>I/I/2/2B/2SI</td>
<td>397.09</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td></td>
<td></td>
<td><strong>3732.94</strong></td>
</tr>
</tbody>
</table>

(Source: India State of Forest Report 2013)

The state has a tropical savannah climate, designated under the Koppen climate classification. The undulating topography leads to local variations, particularly in the hill ranges. The four main seasons are winter, from December to February; pre-monsoon or summer, from March to April; monsoon, from May to September; and post-monsoon, from October to November. A summary of forest resources district wise forest areas are presented in (Table-2) and (Table–3):

**Table-2: Forest Resource**

<table>
<thead>
<tr>
<th>Sl. No.</th>
<th>District</th>
<th>Area (sq. km)</th>
<th>% Cover</th>
<th>Forest Types</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>North Dist</td>
<td>846.567</td>
<td>13.4</td>
<td>Mixed Evergreen Forest</td>
</tr>
<tr>
<td>2</td>
<td>Dhalai Dist</td>
<td>1859.368</td>
<td>29.5</td>
<td>Mixed Moist Forest</td>
</tr>
<tr>
<td>3</td>
<td>West Dist</td>
<td>214.582</td>
<td>3.4</td>
<td>Mixed Forest</td>
</tr>
<tr>
<td>4</td>
<td>South Dist</td>
<td>940.618</td>
<td>14.9</td>
<td>Tropical Evergreen Forests</td>
</tr>
<tr>
<td>5</td>
<td>Gomati</td>
<td>1125.133</td>
<td>17.9</td>
<td>Tropical Evergreen Forests</td>
</tr>
<tr>
<td>6</td>
<td>Sepahijala</td>
<td>344.056</td>
<td>5.5</td>
<td>Mixed Forest</td>
</tr>
</tbody>
</table>

**Table-3: District-wise areas of forest cover in the State**

<table>
<thead>
<tr>
<th>Sl. No.</th>
<th>District</th>
<th>Area (sq. km)</th>
<th>% Cover</th>
<th>Forest Types</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>North Dist</td>
<td>846.567</td>
<td>13.4</td>
<td>Mixed Evergreen Forest</td>
</tr>
<tr>
<td>2</td>
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<td>1859.368</td>
<td>29.5</td>
<td>Mixed Moist Forest</td>
</tr>
<tr>
<td>3</td>
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<td>214.582</td>
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</tr>
<tr>
<td>4</td>
<td>South Dist</td>
<td>940.618</td>
<td>14.9</td>
<td>Tropical Evergreen Forests</td>
</tr>
<tr>
<td>5</td>
<td>Gomati</td>
<td>1125.133</td>
<td>17.9</td>
<td>Tropical Evergreen Forests</td>
</tr>
<tr>
<td>6</td>
<td>Sepahijala</td>
<td>344.056</td>
<td>5.5</td>
<td>Mixed Forest</td>
</tr>
</tbody>
</table>
The State is located in the Bio-geographic zone of 9B-North-East Hills and is extremely rich in bio-diversity. The State Government has set up a total of 4 Sanctuaries covering 604 sq. km for in situ conservation. Details of the four sanctuaries are given in Table-4.

Table – 4: Sanctuaries in Tripura

<table>
<thead>
<tr>
<th>Sl.No</th>
<th>Name of the sanctuary</th>
<th>Area in Sq Km</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Sepahijala Wildlife Sanctuary</td>
<td>18.540</td>
</tr>
<tr>
<td>2</td>
<td>Gumti Wildlife Sanctuary</td>
<td>389.540</td>
</tr>
<tr>
<td>3</td>
<td>Trishna Wildlife Sanctuary</td>
<td>194.710</td>
</tr>
<tr>
<td>4</td>
<td>Roa Wildlife Sanctuary</td>
<td>0.860</td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td><strong>603.650</strong></td>
</tr>
</tbody>
</table>

Materials and methods

Study area:
The study was carried through the different forest types in Tripuraincluding five mountain ranges—Boromura, Atharamura, Longtharai, Shakhan and Jampui Hills—run north to south, with intervening valleysin the whole year, during which the average maximum and minimum temperature was 29°C and 16°C, respectively and the average relative humidity was 70%. The survey was conducted in different forest ranges of different districts and lichensacross a variety of habitats in the region were searched. The samples were collected from different trees up to a height of about 4-7m and from tree barks, twigs and stems from the forest floor with well-colonized lichens. Specimens were collected in paper bags and brought to the laboratory for identification using standard keys. Specimens are preserved in the Laboratory of the Forest Research Centre for Livelihood Extension (FRC-LE), Agartala and Forest Research Centre for Bamboo and Rattan (FRC-BR) Aizawl, Mizoram, India. The collected specimens were investigated morphologically by Leica Stereo EZ4 HD microscope, anatomically by Leica DM 750 light microscope and chemically by Thin Layer Chromatography (TLC) techniques. Lichen substances were identified with thin layer chromatography (TLC) in solvent system A (toluene: dioxane: acetic acid: 180:60:8 ml) using the technique of Walker and James (1980). The colour tests were performed with the usual reagents, i.e. K (5% potassium hydroxide), C (Aqueous solution of calcium hypochlorite and P (paraphenylene diamine). In each sampling plot it has been registered the altitude and the geographic coordinates for sample collection.

Results

Lichen Survey:
Table 5: Forest ranges covered during the Lichen Survey

<table>
<thead>
<tr>
<th>Sl.No</th>
<th>District</th>
<th>Ranges/ Subdivision/ WLS</th>
<th>No of lichen samples collected</th>
<th>Forest types</th>
<th>Associated host</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>North Tripura</td>
<td>Kanchanpur Subdivision</td>
<td>25</td>
<td>Mixed evergreen</td>
<td>Plant Bark, Soil</td>
</tr>
<tr>
<td></td>
<td>District</td>
<td>Choraibari Forest Range</td>
<td></td>
<td></td>
<td>Plant Bark</td>
</tr>
<tr>
<td>2</td>
<td>Unakoti District</td>
<td>Kumarghat Subdivision</td>
<td>19</td>
<td>Dense Forest</td>
<td>Plant Bark, dried twig</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Kailashahar range</td>
<td>10</td>
<td></td>
<td>Plant Bark</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Pecharthal range</td>
<td>11</td>
<td></td>
<td>Plant Bark</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Machmara range</td>
<td>5</td>
<td></td>
<td>Plant Bark</td>
</tr>
<tr>
<td>3</td>
<td>Dhalai Tripura</td>
<td>Longthorai Valley</td>
<td>11</td>
<td>Mixed Moist Forest</td>
<td>Plant Bark, Soil, Rock</td>
</tr>
<tr>
<td></td>
<td>District</td>
<td>Ambassa</td>
<td>14</td>
<td></td>
<td>Plant Bark, dried twig</td>
</tr>
<tr>
<td>4</td>
<td>Khowai Tripura</td>
<td>Khowai</td>
<td>8</td>
<td>Moist Mixed Deciduous Forests</td>
<td>Plant Bark, twig, Plant leaf</td>
</tr>
<tr>
<td></td>
<td>District</td>
<td>Teliamura</td>
<td>19</td>
<td></td>
<td>Plant Bark, twig, Plant leaf</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Baramura range</td>
<td>16</td>
<td></td>
<td>Plant Bark, twig,</td>
</tr>
<tr>
<td>5</td>
<td>West Tripura</td>
<td>Mohanpur Subdivision</td>
<td>8</td>
<td>Mixed Forest</td>
<td>Plant Bark</td>
</tr>
<tr>
<td></td>
<td>District</td>
<td>Hezamara Forest range</td>
<td>9</td>
<td></td>
<td>Plant Bark</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Champaknagar Mandai Forest range</td>
<td>16</td>
<td></td>
<td>Plant Bark, plant leaf</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Gandhigram Forest Range</td>
<td>18</td>
<td></td>
<td>Plant Bark</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Nagicherra Forest Range</td>
<td>5</td>
<td></td>
<td>Plant Bark</td>
</tr>
<tr>
<td>6</td>
<td>Sepahijala</td>
<td>Bishalgarh range</td>
<td>8</td>
<td>Mixed Forest</td>
<td>Plant Bark, soil</td>
</tr>
<tr>
<td></td>
<td>District</td>
<td>Jampuijala forest range and</td>
<td>11</td>
<td></td>
<td>Plant Bark</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Melaghar forest range, Sonamura Subdivision</td>
<td>17</td>
<td></td>
<td>Plant Bark, leaf part, soil</td>
</tr>
<tr>
<td>7</td>
<td>Gomati District</td>
<td>Udaipur Subdivision</td>
<td>13</td>
<td>Tropical Evergreen Forests</td>
<td>Plant Bark</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Dumbur, Amarpur range</td>
<td>24</td>
<td></td>
<td>Plant Bark, dried twig, leaf part, soil, rock, Bamboo</td>
</tr>
</tbody>
</table>
Around 378 lichen specimens were collected (Table 5) from each of the following substrates rocks, soil, bark of living trees and deadwood/ dead twig, soil, from different forest ranges and different forest types in Tripura. All lichens were considered apart from the crustose lichens on the bark of living trees.

Table 6: District wise lichen sample collection (till date)

<table>
<thead>
<tr>
<th>Districts</th>
<th>No of samples collected</th>
</tr>
</thead>
<tbody>
<tr>
<td>North Tripura District</td>
<td>35</td>
</tr>
<tr>
<td>Unakoti District</td>
<td>45</td>
</tr>
<tr>
<td>Dhalai Tripura District</td>
<td>25</td>
</tr>
<tr>
<td>Khowai Tripura District</td>
<td>43</td>
</tr>
<tr>
<td>West Tripura District</td>
<td>56</td>
</tr>
<tr>
<td>Sepahijala</td>
<td>36</td>
</tr>
<tr>
<td>Gomati District</td>
<td>69</td>
</tr>
<tr>
<td>South Tripura District</td>
<td>69</td>
</tr>
<tr>
<td>Mean</td>
<td>47.25</td>
</tr>
<tr>
<td>SD</td>
<td>16.11344</td>
</tr>
</tbody>
</table>

Table 6: District wise lichen sample collection (till date)
Figure 1 shows the percentage wise distribution of lichen samples collected from different forest types. The maximum percentage (30%) of lichen samples were collected from tropical evergreen forest and 26 percent from mixed moist forest.
whereas only (7%) percent of lichen samples were collected from mixed moist forest. Due to their physiology, lichens are sensitive to a series of environmental parameters (namely light, air humidity, UV-B radiation, temperature, and airborne chemicals such as SO2 and NOx) making them useful indicators for air pollution and climate change (Poikolainen et al. 1998; Tarhanen et al. 2000; Cornelissen et al. 2001; Kricke and Loppi 2002; Castello and Skert 2005). Abundant rainfall and temperature under tropical ecosystem supports the mycobiont association. Among the host the plant bark contributed the maximum (78%). Lichen association was also found on rocks (1%) and bamboo shoots (1%). The identification of lichen samples based on morphological, anatomical and chemical analysis revealed that Cryptothecia striata was one of the most abundant crustose lichens found in occurring on Tree bark and Leaves. Dirinaria aegialita is another dominant sub-foliose species. Leaves of under-storey plants in thick forests were occupied by follicolous lichen genera such as Strigula elegans, Calopadia etc.

**Discussion**

The forests of Tripura are rich in biodiversity. Undulating terrain and good annual rainfall support rich diversity of fauna and flora. Lichen is one such group which need proper investigation in order to appreciate its diversity and also to find out as which species are threatened due to anthropogenic activities. Lichen communities are being used to assess the air quality and forest health. Lichen communities are being used by forest land managers to detect and monitor the trends in forest ecosystems. This rich diversity indicates good forest health. Owing to close ecophysiological links, lichens are also recognized as promising candidates for air quality bio monitoring (Rout 2007). The present study reveals that the maximum numbers of lichen diversity has been found in Gomati Tripura and South Tripura district (69 numbers of lichen specimens respectively) which are abundant with tropical evergreen forest.

**Acknowledgements**

This study is carried out under an ongoing ICFRE funded research project entitled, 'Assessment, Documentation, and Characterization of Lichen Diversity in Tripura, North-east India'. The authors are sincerely grateful to Dr. S.C. Gairola, IFS, Director General, Indian Council of Forestry Research and Education (ICFRE), Dehradun for his kind patronage. We thank Dr. R.S.C. Jayaraj, IFS, Director, Rain Forest Research Institute (RFRI), Jorhat, Assam for his continuous support and guidance. Authors are also thankful to Head of office, Forest Research Centre for Livelihood Extension (FRC-LE), Agartala for every possible support required during the field surveys.

**References**


Dalbergia lanceolaria L.f.: Prospect of a lesser known tree species in India

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Introduction
Dalbergia lanceolaria L.f. belongs to Fabaceae family is commonly known as “Bastard rose wood” It is deciduous in nature and attains height up to 30 m having diameter of 30-60 cm with bark rough, flaking. It is an eye catching tree when profusely covered with flowers and young leaves. Generally bark pale grey with greenish yellow tinge, compound leaf having 17 leaflets whereas lilac flower, fruit thin, flat pod, tapering ends. It is native to India and distributed in Bhutan, Nepal, Pakistan, Sri Lanka, Bangladesh, Myanmar, Thailand, Cambodia, Laos, Vietnam. This tree species is well distributed throughout India except Jammu & Kashmir, Punjab, Haryana, Himachal Pradesh, Uttarakhand, Uttar Pradesh, Bihar, Jharkhand, Odisha, Sikkim, and Arunachal Pradesh. It is generally found upto elevation of 500 meters and frequent member in deciduous forests. In the initial stages of growth, needs shade later on required abundant light for better growth and development. The phenological aspects which provides information regarding timing of flowering, time of fruiting and falling and helps in tree improvement program as well as propagation through nursery activities respectively. In this regard D. lanceolaria the leaf falling period varies from January to March, leaf flushing period April to May, flowering period April-May and fruiting period September to December.

Different parts of trees particularly seed and bark are used in the Ayurveda, Folk medicine, Sowa-Rigpa, Siddha. In other uses, it is used for atmospheric nitrogen fixation into soil, wind break for microclimate enhancement, nectar source for honeybees, and timber for various end uses and in addition to these leaves are used as a fodder for livestock animals. The various commercial uses of the tree species in details are as

Commercial Uses
The wood is white or yellowish white with no distinct heartwood. It is moderately hard and heavy, straight or interlocked grained and medium coarse textured. It is easy to saw and work. The wood is used for tool handles, boats, rafters, scantlings, packaging and other general purposes (Pearson and Brown, 1932). Baptoigenin from leaves and flowers possesses properties to treat arthritic affections and inflammations. An isoflavone glycoside of biochanin (lanceolarin) has been obtained from the root bark. The heartwood of Dalbergia spp. contains quinones. Bark and pods contain tannins. Seed oil of D. lanceolarla is used in rheumatic affections. The bark of D. lanceolaria trees mixed with Flacourtia spp. for external application during intermittent fever (Anon., 1976) and an infusion of it is consumed to cure dyspepsia. Leaves of D. lanceolaria are medicinal as alternative stimulants and also as curatives for leprosy and other skin diseases and against apthane. Root extract of D. lanceolaria is
used to cure cutaneous diseases and also ulcers. The seeds of *D. lanceolaria* contain extractable oils of medicinal value. A decoction of bark used in dyspepsia. Oil applied to rheumatic affections, and cutaneous diseases. Leaf is used in leprosy and allied obstinate skin diseases.

**Conclusion**

*Dalbergia lanceolaria* a lesser known tree species well distributed in India has a great potential in Ayurveda, Folk medicine, Sowa-Rigpa, Siddha and can be popularized among farmers for commercial uses.

**References**


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**Photographs of *Dalbergia lanceolaria***

![Tree](image1)

![Leaves](image2)

![Flowers](image3)

![Fruits](image4)
Prospective of lesser known tree species: Malabar orchid
(Bauhinia malabarica Roxb.)


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Introduction

*Bauhinia malabarica* Roxb., popularly known as ‘Malabar orchid or Mountaintain ebony’ belongs to Fabaceae family is an evergreen or nearly evergreen tree 4-17 m tall and diameter usually up to 50 cm with a short often gnarled bole. It is native to Australia, India, Indonesia, Malaysia, Myanmar, Philippines and Thailand. In India, it is distributed throughout the greater parts except the driest tract receiving less than 500 mm annual rainfall (Troup, 1921). In the sub-Himalayan tract, it extends from Yamuna eastwards to Assam, ascending up to 600-670 m elevation. It is also found in the central India, Bihar, Andhra Pradesh, Odisha, Gujarat and in the western Peninsula. *B. malabarica* occurs in the middle story of South and North Indian moist deciduous forests as well as Northern tropical dry deciduous forests (Champion & Seth, 1968).

Bark is rough brown, peeling in linear flakes, fibrous, red inside. Leaves are 1.5-4 inches long, 2-5 inches broad, divided through 1/3 of the length, 7-9 nerved, slightly heart shaped at base, rigidly leathery, glaucous and smooth beneath (Balasundram *et al.*, 2006). Flowers are borne in stalk less racemes in leaf axils, 1.5-2 inches long. Flowers are 1/2 inch long, dull white, often unisexual, on very slender stalks. Male and female flowers are usually on different stems. Sepal cup has five equal triangular teeth. Petals are spade shaped, equal. Pod is 7-12 inches long, 2-2.5 cm broad, on a stalk 1 inches long, flat flexible, many seeded, more or less straight reticulate veins, which starting diagonally from both sutures meet in the middle (Barnes *et al.*, 2001; Bocco *et al.*, 1998).

Climate and Soil

Malabar orchid is a plant of tropical and sub-tropical climates. In its natural range of distribution, the absolute maximum and minimum shade temperature varies from 35°-43°C and 0°-17°C respectively. The species tolerates a wide range of rainfall varying from 300 mm to 3000 mm, but avoids too dry and wet areas. In the drier tracts, it however likes moist localities in the vicinity of streams. The tree is found on a variety of soils supporting mixed deciduous forests.

Silvicultural Characters and Phenology

The tree is light demander but avoids dry sites. The seedlings are somewhat frost tender but the trees are frost hardy. The trees are browsed by cattle. The seeds germinate early in the rainy season, mainly around mother trees. Birds and insects cause a great deal of mortality by eating off the radicals. Seeds embedded slightly by washing off soils on gentle sloping lands get better chances of survival.
The tree is nearly evergreen; as it shed its leaves for a very short duration during the dry season and the new flush of leaves sometimes appear before the old leaves fall. Flowering generally takes place during the months of September to January, but in northern India it flowers from August to October. The pods develop rapidly afterwards and ripen from January to May, the pods normally hang on the trees in large numbers, but may dehisce on the trees in the hot summers or fall before dehiscing.

**Nursery Practices**

The ripe pods are collected from the trees, dried in the sun and thrashed to obtain seeds. About 1100-1200 seeds weigh a kg. The seeds retain viability to some extent for a year (Dent, 1948). Fresh seed should be used for sowing, as the germinative capacity of the seed is low.

Fresh seeds are sown in drills about 20-25 cm apart, the depth of sowing being 5 mm. Seed germination starts within a week and continues for some time. The germinative capacity in the open is reported to be 14% while in the shaded nursery beds, it is slightly higher (18%). The seedling growth is slow under the natural conditions, the plants attaining a height of 10, 50 and 170 cm during the first, second and third seasons respectively (Troup, 1921). However, weeding and watering stimulate the growth. Seedling should be planted out during the first rains as the development of long tap root prevents successful planting later on. Planting is done I July in pre dug pits spaced at 2.5m × 2.5m to 3m × 3m.

**Utilization**

The wood is light reddish brown, straight grained and medium coarse textured. It is moderately heavy, moderately hard and strong. It is moderately durable under cover but liable to white ant attack. The timber is refractory to seasoning and liable to develop honey comb cracks. The wood is provides temporary construction material in rural areas. The wood is suitable material for charcoal and fuelwood, the energy value of the wood is about 18 100 kJ/kg. The leaves are used as fodder and rated as a good fodder. The bark fibre is used to make rope.

The young leaves are used as a condiment and cooked together with fish or meat to give the soup a good smell and flavour. The seeds of Malabar orchid are rich in minerals like Ca, Mg and Fe. Glutelins (45%) and globulins (34%) constituted the major seed protein fraction. The amino acids tyrosine and phenylalanine are fairly high.

The young shoots of *B. malabarica* are edible and is being commonly prescribed to treat cough, gout, glandular swellings and goiter, haemorrhage, leprosy, menorrhagia, scrofula, urinary disorders, wasting diseases, worm infestations and wounds (Ahmed et al., 2012) and for liver disorders (Venkatachalapathi et al., 2015) by the folkloric medical practitioner in Malabar coast and Walayar valley of southern India. The pounded bark is used in Timor as a poultice. The leaves are used as a febrifuge and the flower infusion as an anti-dysenteric. Root and stem of this plant used for the treatment of cholera would heal diuretic and dysentery (Chandra et al., 2010).

**Conclusion**

*Bauhinia malabarica* is a very useful lesser known plant. The tree parts are used
for various purposes such as fuelwood, fodder, fibre, folk medicines *etc.* and needs popularize among farmers or tree growers. Scanty research works were carried out for its propagation and sustainable utilization, hence scientists should give more emphasis for this tree species for its propagation and end use utilization.

**References**


Photographs of *Bauhinia malabarica*

- Tree
- Leaves
- Flowers
- Fruits
- Seeds
- Bark
Utilization and silviculture of a lesser known tree species:

*Sterculia villosa* Roxb.

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**Introduction**

*Sterculia villosa* Roxb., also known as Udal or Odal or Udar is a moderate sized deciduous tree belongs to family Sterculiaceae. It is widely distributed almost throughout the greater part of India, up to an elivation of 1000 m, particularly in the state of Uttar Pradesh, Bihar, West Bengal, Assam, Odisha, Gujarat, North Eastern states and hills of South India including Andaman and Nicobar Islands. It is typically found in the *Terminalia tomentosa* forest and in alluvial savanna forest of India. It grows well in light sandy or gravelly soils with annual rainfall ranges from 750-4000 mm. The tree generally attains up to a height of 15-20 m with a girth of 1.2- 1.5 m. Wood is very soft and light possessing pale yellowish or grayish white to light grayish or brown (Morton and Thomas, 1977).

*S. villosa* is native to India and it is one of the indigenous fast growing tree species. It possesses certain paper making characteristics. The plant is generally used for making tea boxes and light weight packing cases, apart from use as fire wood in the rural areas. The plant can be raised from seeds and also from stem cuttings. Udar can grow majestically tall in dry deciduous forest with a straight trunk devoid of branches upto 5 or 6m. Along a forest edge, it is common to see vast numbers of seedlings with their outsize leaves sprouting in cleared patches.

**Morphology and Phenology**

Bark is shiny and smooth in young trees, with horizontal wrinkles; becoming rougher with prominent lenticels and thin, papery outer bark. Leaves with 25-40 cm long, broad, heart shaped at the base, lobes somewhat oblong or obovate entire, held aloft by even longer stalks; palmately 5-7 lobes, with the lobes often broken up into short, pointy sub-lobes; base is deeply heart shaped; undersurface velvety long hairs beneath, gradually becoming more or less smooth on top. Flowers are borne in panicles 15- 30 cm long, rusty velvety, pendulous. Flowers are unisexual, with stalks 4-8 mm long. Sepal cup is bell shaped, 5 partite, 6-10 mm long, 10-15 mm across, yellow with pinkish throat. Sepals are lance shaped, 4-6 mm long, pointed. The column of stamens is 4- 5 mm long, recurved. Branching clusters produced at the ends of bare shoots; male and female flowers are mixed; they have no petals; calyx yellow with dark pink veining inside at base, bell shaped with 5 spreading, petaloid lobes, hairy outside; male flowers have 10 anthers; female parts are raised on a hairy, cylindric column; the stigma is 5 lobed. Fruits are 3-5 boat shaped follicles about 3-5cm long, leathery, rusty pubescent, many seeded, radiating out from where these are attached to a common stalk; covered all over with long, soft hairs; grey green at
first, becoming bright red when ripe. Seeds are oblong, smooth, black.

The phenological characters are summarized as:

<table>
<thead>
<tr>
<th>Leaf fall</th>
<th>Leaf renewal</th>
<th>Flowering period</th>
<th>Fruiting period</th>
</tr>
</thead>
<tbody>
<tr>
<td>December to April</td>
<td>May to June</td>
<td>February to March</td>
<td>March to June</td>
</tr>
</tbody>
</table>

**Utilization of *S. villosa***

The strong coarse fiber obtained from the inner bark, is used for ropes, bags, cordage, elephant harness and dragging timber. It is reported to make ‘a very bad fuel’. It’s seeds are very quick to germinate and is likely to be useful for afforesting degraded areas. The plant had been reported for significant therapeutic activity including diuretic, cooling and aphrodisiac properties. Sherbet is recommended in urinary problems and rheumatism which is prepared from the petiole along with water and sugar. The bark and the petiole are used as a medication in seminal weakness and leaves are used in impotency. White exudates of the tree are applied for throat infection and whole plant extract is helpful for skin diseases. Wood is used to preparing tea boxes, toys, guitars, cheap match boxes, splints and also for manufacturing of commercial plywood grade IV. It is served as good raw material for pulp and paper industries (Barua and Rabha, 1992). The seeds are eaten like a pulse after roasting or cooking. The whitish pellucid gum exudes from the bark, locally known as katila gum, is used as a substitute for gum tragacanth which posses high medicinal value. It is used as an adhesive for dental fixtures and ostomy equipment and as a base to a salicylic acid patches. Further gum is used to normalize blood sugar and plasma lipid levels, but this has not been thoroughly investigated. The gum is also used as an ingredient in lozenges to relieve sore throat due to the demulcent properties.

**References**


Photographs of *Sterculia villosa*
Flowers

Leaves

Fruits

Seed
Trees outside forest (TOF) in urban environment of Sarguja

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Abstract
The study on tree outside forest (TOF) in urban environment was carried out in east and west directions/aspects at various sites of Ambikapur in Sarguja district (Chhattisgarh). A survey was conducted in various location of Ambikapur to record the TOF. In the present study overall 46 species distributed into 23 families were recorded. The most dominant family was Leguminaceae. In the east aspect a sum of 44 species representing 23 families were recorded while in the west aspect 36 plant species distributed among 19 families were recorded. Almost similar types of flora are occurring in both the aspect except Terminalia bellerica, Terminalia chebula, Samanea saman, Cassia siamea, Ceiba pentandra, Punica granatum, Anthocephalus cadamba, Citrus limonia, Litchi chinensis and Madhuca indica occurring only in east direction while Delonix regia and Ficus glomerata distributed in west aspect only. Urban trees are threatened by social development and urbanization and their protection as well as conservation is only possible when their true values were accounted i.e. energy conservation, pollution reduction, carbon sequestration, recreational values, biodiversity and environmental security etc, so that it become compulsory for planners for urban development.

Keywords: Aspect, Recreational, TOF, Urban environment

Introduction

The vegetations have a substantial role in various dimensions including environmental, ecological, social and cultural values in addition to the global carbon cycle. The tree resources chiefly related to the forest landscape, beside this there is extensive floral wealth which subsists outside the forest ecosystem (Pawar et al., 2014a, 2014b; Singh, 2017). FAO (2005) defines TOF as trees available on lands which is not defined as forests or other wooded land (FAO, 2010). According to FSI (2011) TOF are those trees which have 10 cm or more DBH (diameters at breast height) available on land which is not notified as forests. Tree outside forests (TOF) are the trees available on various sites like agroecosystem, avenue site, road side, along water bodies, orchards, parks, wood lots and homestead etc (Singh and Chand, 2012). A large number of TOF consists of planted or domesticated trees (Kumar et al., 2014; Jhariya et al., 2013). As per Zomer et al. (2009) on global scale nearly 46% of the agricultural land (> 1 billion ha) has tree cover >10% as TOF. The total area of other woodland with tree cover was estimated to be 79 million ha, still now the information in this regard is limited and scare from different parts of the world (FAO, 2010).

Trees are important part of the urban landscape and have substantial roles in people life. The continued rise in human populations, coupled with shrinking forests
and degraded ecosystems (FAO, 2005; Pawar et al., 2012; Jhariya and Raj, 2014), TOF are bound to play a greater role in meeting the challenges of resource sustainability, poverty reduction and food security (Jhariya et al., 2015, 2018). They also contribute towards improving air & water quality, facilitate various environmental, ecological and social benefits and services similar to forest ecosystem like conservation of biodiversity and carbon sequestration (FAO, 2005). Still, in various countries, TOF are poorly reported and primary information is often lacking. Thus, TOF are most often ignored in development policies and land-use planning (FAO, 2010). Hence, the reliable information on TOF presence, spatial distribution type, quality and temporal changes is needed, particularly in the larger areas where forest cover is very less (FAO, 2005).

The study was conducted in East and West directions of Ambikapur, Sarguja district. The enumeration of TOF was done in both the directions and species were recorded separately along with their presence (location wise). Intensive field studies were conducted in a planned manner repeatedly in different sites in order to document maximum representation of species. In each of these areas all the plant species encountered were identified and finally, TOF were documented by following their botanical name, local name etc by their locality.

**Result and Discussion**

**Assessment of TOF**

There are many plant species widely available in different localities of the study site. Some localities showed the presence of more diverse flora while some localities seemed to poor in vegetation occurrence. In the present study overall 46 species distributed into 23 families were recorded (Table 1). The most dominant family was Leguminaceae while Anacardiaceae, Bixaceae, Bombaceae, Dipterocarpaceae, Lamiaceae, Moringaceae, Musaceae, Punicaceae, Rhamnaceae, Rubiaceae, Sapindaceae, Sapotaceae and Verbenaceae were represented by single species. It seems from the table 1 that almost similar types of flora are occurring in the both aspect except *Terminalia bellerica*, *Terminalia chebula*, *Samanea saman*, *Cassia siamea*, *Ceiba pentandra*, *Punica granatum*, *Anthocephalus cadamba*, *Citrus limonia*, *Litchi chinensis* and *Madhuca indica* occurring only in east direction while *Delonix regia* and *Ficus glomerata* distributed in west aspect only.
TOF Status in East Aspect

In the east aspect three sites (viz., Bauripara, Kamalpur and Mahamaya road and hill) were enumerated to assess the TOF. Overall 44 species representing 23 families were recorded in the east aspect of the study sites. A total of 22 species representing 13 families were recorded in Bauripara site. The family Leguminaceae was found to be dominant and nearly 31.82% species represented by this family while 10 families (45.46%) showed single species. In Kamalpur site 22 species with 16 families were recorded. Leguminaceae family found to be dominant while 12 families were represented by single species. A sum of 21 species with 13 families were observed in the Mahamaya road and hill site and 9 families showed representation of single species. The most frequent species in Bauripara site represented by Leguminaceae family (7 species), while the single family were represented by Anacardiaceae, Apocynaceae, Bixaceae, Bombacaceae, Euphorbiaceae, Meliaceae, Myrtaceae, Rhamnaceae, Rubiaceae and Rutaceae. Similarly, in the Kamalpur and Mahamaya road and hill sites most of the species comprised by Leguminaceae family i.e., 4 and 5 species in respective sites.

In Bauripara site 17 species were distributed in and around the road side followed by home stead (12 species) and institutional locality (11 species). The locality-wise presence of species (Table 2) reflected that most occurred species were Acacia nilotica, Annona squamosa and Azadirachta indica and least occurred species were Polyalthia longifolia and Albizia spp. Similarly, in Kamalpur site (table 3) maximum species was recorded in and around road side locality. The Mangifera indica was found in all the site of this site followed by Psidium guajava, Azadirachta indica and Tamarindus indica. The least reported species Melia azedarach, Moringa oleifera, Musa Paradisiaca, Nerium indicum, Ricinus communis and Terminalia arjuna across different surveyed locality. Mahamaya road and hill site (table 4) showed that most species were recorded in private land followed by road side locality. The most distributed species were Acacia nilotica, Azadirachta indica, Ficus religiosa and Mangifera indica while the least occurred species were Punica granatum and Terminalia bellerica.

TOF Status in West Aspect

Two sites (viz., Ajirma and Thakurpur) were selected to assess the TOF in the west aspect of the study site. A sum of 36 plant species distributed among 19 families was recorded in the west aspect of the study area. A total of 22 species representing 13 families were recorded in Ajirma (table 5) and 22 species with 12 families were found in Thakurpara sites (Table 6), respectively. The most dominant family was Leguminaceae in both the sites i.e. Ajirma and Thakurpur site which comprised 7 species and 5 species, respectively.

Ajirma site reflected that the maximum species were found in institutional site followed by home stead and road side. The most distributed species was Ficus religiosa followed by Ficus glomerata and Ficus benghalensis. The rare occurrence was recorded for Bauhinia spp. and Nerium indicum. Thakurpur site revealed that most of the species were distributed in home stead and road side locality while the least species were recorded at between road and drain line site. The widely distributed species were Aegle marmelos, Azadirachta indica, Syzygium cumini and
Ziziphus mauritiana while the rare species was Albizia spp., Bixa orellana, Cassia fistula, Murraya koenigii and Ricinus communis over the different localities.

There are many plant species widely available in different localities of the study sites. There are many trees widely available in home stead, road side and private land. Beside it a substantial numbers of individuals were found in the proximity of institutional land. The occurrence of TOF was found least at between road and other site locality which are mostly planted or domesticated to derive the various outputs. Similar to this, Pandey (2008) reported that most of these resources (TOF) available under human management fall in private ownership of smallholders. TOF were species rich, likely due to deliberate planting of different tree species, especially for category of TOF around homestead so as to meet various outputs. These resources have noticeable value for small and marginal farmers or growers (Arnold, 1996). FAO (2001) described that these trees are definitely in a very strong position to considerably alleviate the pressure on forest resources, conserve farmlands, boost agricultural productivity, and blunt the harmful impact of urban growth on the environment.

Moriga et al. (2014) reported 15 tree species encountered in farming landscape/agroforestry in Tanzania. Furthermore, they reported a total of 59 tree species identified as TOF in Tanzania which support the present findings. In Matombo, Morogoro, Tanzania, Mugasha (2009) encountered 8 tree species in agroforestry system. The present findings were also comparable with Yossi and Kouyaté (2002) they reported 11-40 species for Mali as TOF. In the same region Kojwang and Chakanga (2002) were found 20 species of TOF. Glen (2002) in Sudani reported lower (33 tree species) values of species composition in TOF check list as compare to present work. Holding et al. (2004) reported that fruit trees grown as a source of fruits, was now also being converted to timber and firewood for commercial purposes. Most farmers use diverse species to various locality of the land, demarcate farm and boundaries, stabilization of roads and windbreaks. In addition to derived the fuelwood, construction poles, farming implements, small timbers and furnishing timber (Ngayambaje and Mohren, 2011). Besides this, the farmers also grow trees for business and/or for financial security (Kweka et al., 2007).

**Conclusion**

There is a lot of variation in the tree presence and their diversity in different aspect and location of the study sites. A large number of TOF recorded in the study sites were planted or domesticated species than naturally occurred. Trees planted along road side, institution and other localities, represent planted timber species. While in homestead most of the species comprises horticultural species. These TOF resources providing many environmental and ecological services, besides the greening urban environment which facilitate unique aesthetic and recreational values, reducing pollution, alleviate poverty and livelihood security through rendering fruit, fodder, fuelwood, timber and other basic demand of urban people. So, recognition and understanding of TOF significance in urban ecosystem is required along with policy initiative towards natural resources planning and consider it as an integral component of
urban landscape development and management.

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Table 1: List of tree outside forests (TOF) found in study sites

<table>
<thead>
<tr>
<th>Family</th>
<th>Common Name</th>
<th>Botanical name</th>
<th>Uses/Part Use</th>
</tr>
</thead>
<tbody>
<tr>
<td>Anacardiaceae</td>
<td>Mango</td>
<td>Mangifera indica (E,W)</td>
<td>Fruit, Economic value, fuel wood</td>
</tr>
<tr>
<td>Annonaceae</td>
<td>Sheetaphal</td>
<td>Annona squamosa (E,W)</td>
<td>Edible fruit, medicinal value</td>
</tr>
<tr>
<td></td>
<td>False Ashok</td>
<td>Polyalthia longifolia (E,W)</td>
<td>Medicinal value</td>
</tr>
<tr>
<td>Apocynaceae</td>
<td>Saptpardi</td>
<td>Alstonia scholaris (E,W)</td>
<td>Medicinal value</td>
</tr>
<tr>
<td></td>
<td>Kaner</td>
<td>Nerium indicum (E,W)</td>
<td>Medicinal value</td>
</tr>
<tr>
<td>Bixaceae</td>
<td>Sinduri</td>
<td>Bixa orellana (E,W)</td>
<td>Seed</td>
</tr>
<tr>
<td>Bombacaceae</td>
<td>Semal</td>
<td>Bombax ceiba (E,W)</td>
<td>Medicinal value</td>
</tr>
<tr>
<td>Combretaceae</td>
<td>Arjun</td>
<td>Terminalia arjuna (E,W)</td>
<td>Medicinal, Silk host</td>
</tr>
<tr>
<td></td>
<td>Bahera</td>
<td>Terminalia bellerica (E)</td>
<td>Medicinal value</td>
</tr>
<tr>
<td></td>
<td>Harra</td>
<td>Terminalia chebula (E)</td>
<td>Medicinal value</td>
</tr>
<tr>
<td>Dipterocarpaeae</td>
<td>Sal</td>
<td>Shorea robusta (E,W)</td>
<td>Gum, Timber wood</td>
</tr>
<tr>
<td>Euphorbiaceae</td>
<td>Amla</td>
<td>Emblica officinalis (E,W)</td>
<td>Edible fruit, timber wood, medicinal</td>
</tr>
<tr>
<td></td>
<td>Rattanjot</td>
<td>Jatropha carcus (E,W)</td>
<td>Making biofuel, Live fence</td>
</tr>
<tr>
<td></td>
<td>Castor</td>
<td>Ricinus communis (E,W)</td>
<td>Medicinal value, Oil</td>
</tr>
<tr>
<td>Lamiaceae</td>
<td>Teak</td>
<td>Tectona grandis (E,W)</td>
<td>Timber wood</td>
</tr>
<tr>
<td>Leguminaceae</td>
<td>Sisham</td>
<td>Dalbergia sissoo (E,W)</td>
<td>Timber, medicinal value</td>
</tr>
<tr>
<td></td>
<td>Gulmohar</td>
<td>Delonix regia (W)</td>
<td>Medicinal value</td>
</tr>
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Table 2: Status of TOF in different locality of Bauripara site (East Aspect) of Sarguja

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Table 3: Status of TOF in Kamalpur site of East Aspect of Sarguja

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Table 4: Status of TOF in Mahamaya road & hill site of East Aspect of Sarguja
Table 5: Status of TOF in Ajirma site of West Aspect of Sarguja

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</table>

Table 6: Status of TOF in Thakurpur site of West Aspect of Sarguja

<table>
<thead>
<tr>
<th>Species</th>
<th>Homestead</th>
<th>Roadside</th>
<th>B/W Road</th>
<th>Institutio n</th>
<th>Near Pond</th>
<th>Drain line</th>
<th>Private Land</th>
<th>Others</th>
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<tbody>
<tr>
<td>Acacia nilotica</td>
<td>√</td>
<td></td>
<td></td>
<td></td>
<td></td>
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</tr>
<tr>
<td>Aegle marmelos</td>
<td>√</td>
<td></td>
<td>√</td>
<td>√</td>
<td></td>
<td>√</td>
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</tr>
<tr>
<td>Albizia spp.</td>
<td></td>
<td>√</td>
<td></td>
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<td>Alstonia scholaris</td>
<td></td>
<td></td>
<td>√</td>
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<tr>
<td>Annona squamosa</td>
<td></td>
<td>√</td>
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<tr>
<td>Azadirachta indica</td>
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<tr>
<td>Bixa orellana</td>
<td></td>
<td></td>
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<td></td>
</tr>
<tr>
<td>Cassia fistula</td>
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<td>Dalbergia sissoo</td>
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<tr>
<td>Delonix regia</td>
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<td>√</td>
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<tr>
<td>Gmelina arborea</td>
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<td>Hibiscus rosa sinensis</td>
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<td>Musa paradisiaca</td>
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<td>Nerium indicum</td>
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<td>Polyalthia longifolia</td>
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<tr>
<td>Plant Name</td>
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<tr>
<td><em>Psidium guajava</em></td>
<td>✓</td>
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<td>✓</td>
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<tr>
<td><em>Ricinus communis</em></td>
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<td>✓</td>
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<tr>
<td><em>Syzygium cumini</em></td>
<td>✓</td>
<td></td>
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<td>✓</td>
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<tr>
<td><em>Ziziphus mauritiana</em></td>
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<td>✓</td>
<td>✓</td>
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</tr>
</tbody>
</table>
Diversity of macro-fungi in Central India-XXII: Diversity of *Laetiporus sulphureus* in TFRI campus


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Abstract
Diversity and distribution of *Laetiporus sulphureus* in the campus of Tropical Forest Research Institute, Jabalpur is reported in the present article. The species was collected on two tree species, *Butea monosperma*, *Phyllanthus emblica* and one bamboo *Dendrocalamus strictus*. Earlier the species was reported on *Bambusa vulgaris* var. yellow from the institute campus.

Introduction
*Laetiporus sulphureus* is a species of bracket fungus and it was first described as *Boletus sulphureus* by French mycologist Pierre Bulliard in 1789. It is commonly known as crab-of-the-woods, sulphur polypore, sulphur shelf and chicken-of-the-woods. The fruit bodies grow as striking golden-yellow shelf-like structures on tree trunks and branches. The under surface of the fruit body is made up of pores. Commonly it grows as saprophyte and occasionally as weak parasite, causing brown cubical rot in the heartwood of trees. Fruiting body sometimes grows up to 60cm across; usually consisting of several - many individual caps arranged in a shelving formation or rosette. Fruit bodies grow as bright yellow to bright orange when young, frequently fading at maturity and with direct sunlight. The cap is attached directly to the trunk of a tree and is initially knob-shaped, but soon expands to fan-shaped, typically growing in overlapping tiers. It is sulphur-yellow to bright orange which fade to tan or whitish. The fertile surface is sulphur-yellow with small pores or tubes and has a white spore print. When fresh, the flesh is succulent and exudes a yellowish juice, but soon becomes dry and brittle. The mushroom causes brown cubical rot on the heartwood in the roots, base and stem. At first the wood is discoloured yellowish to red. Later on it becomes reddish-brown and brittle. At the last stage the wood can be rubbed like powder between the fingers. Two another species of the fungus, *Laetiporus huroniensis* and *L. gilbertsonii* are known. *L. huroniensis* grows on hemlock in conifer forests of North America and it fruits on large logs in old growth while *L. gilbertsonii* and edible mushroom grows on *Eucalyptus* (Burdssall and Banik, 2001). *Laetiporus sulphureus* is an edible mushroom some other edible mushrooms recently reported from central India includes: *Astraeus hygrometricus*, *Auricularia auricular-juda*, *Calvatia gigantea*, *Macrocybe crassa*, *M. lobayensis*, *Russula congoana*, *R. delicula*, *Schizophyllum commune* and *Tremella fuciformis*, (Verma et al., 2017 a b; 2018 a b; 2019a b; Verma and Verma, a b).

In the present article diversity of *Laetiporus sulphureus* on different hosts (*Bambusa vulgaris* var. yellow, *Butea monosperma*, *Dendrocalamus strictus* and *Phyllanthus emblica*) are reported from the
Materials and Methods
Specimens were collected from the campus of Tropical Forest Research Institute (N 23°05'431", E79°59'060"), Jabalpur, Madhya Pradesh. The slides were prepared in lacto-phenol and cotton blue and observed under advance Research Microscope, make Leica, Germany and photomicrographs were taken with a digital camera attached to the microscope. Identification of fungus was done with the help of literature (Berkeley 1851; Breitenbach and Kränzlin 1986; Burdsall Jr.et al., 2001; Kuo, 2005; Kyriakou et al., 2009; Lindner and Banik 2008; Mancheño et al., 2005; Sabaet al., 2015; Schwarze et al 2000; Spahr, 2009; Tarafder et al., 2017) and the matter available on net. The specimens were deposited in the Mycology Herbarium, Tropical Forest Research Institute, Jabalpur and got accession numbers.

Results

Laetiporus sulphureus (Bull.) Murrill
(Fomitopsidaceae, Polyporales, Incertae sedis, Agaricomycetes, Agaricomycotina, Basidiomycota)
≡Boletus sulphureus Bull.
=Boletus tenax Lightf.
=Polyporus sulphureus (Bull.) Fr.
≡Sistotrema sulphureum (Bull.) Rebent.
≡Tyromyces sulphureus (Bull.) Donk

Taxonomic Description:
Basidiocarps annual, laterally stipitate to sessile, single to imbricate clusters with narrow base, medium to large size. Pileus 10–13cm long, 14–19cm broad, 1–1.5cm thick near the base, soft, dimidiate to semicircular, flabelliform; upper surface light yellow, brownish near bases, azonate, fading to almost with age on drying, smooth, glabrous; margin white, thick, rounded. Context 4–10mm thick, soft fleshy and watery when fresh, soft and fragile when dry; white to light yellow. Hymenial surface sulphur yellow when fresh, brownish yellow to dark brown on drying. Pores angular circular 1.6-2 pores per mm; tubes up to 5 mm deep, tube layer sulphur yellow when fresh, dark brown on drying; striate to slightly oblique, 1–2.5 mm long. Hyphal system dimitic; generative hyphae, hyaline, thin-walled, simple septate, with rare branching. Binding hyphae 2–7μm wide, hyaline, non-septate, thick-walled, much branched. Basidia clavate, with basal clamp, 4-spored; sterigmata 2–4 μm long (12–20×2.5–7.5μm. Basidiospores ovoid to ellipsoid, smooth, hyaline-light-olivaceous, moderately thick-walled, 4.5–7×4.5–6.0μm (Figs. 1-8).

Table 1: Occurrence of Laetiporus sulphureus at TFRI, Campus, Jabalpur, Madhya Pradesh

<table>
<thead>
<tr>
<th>S.N.</th>
<th>Host</th>
<th>Date of collection</th>
<th>Specimen No. (TF)</th>
<th>Locality</th>
<th>No. of culms/ plants observed</th>
<th>No. of affected plants</th>
<th>Damage (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Bambusa vulgaris var. yellow</td>
<td>03/09/2018</td>
<td>4176</td>
<td>Agro-forestry nursery</td>
<td>15</td>
<td>13</td>
<td>86.7</td>
</tr>
<tr>
<td>2.</td>
<td>Embelica officinalis</td>
<td>03/09/2018</td>
<td>4175</td>
<td>Agro-forestry</td>
<td>5</td>
<td>01</td>
<td>20.0</td>
</tr>
<tr>
<td></td>
<td>Species</td>
<td>Date</td>
<td>Code</td>
<td>Location description</td>
<td>Nursery Type</td>
<td></td>
<td></td>
</tr>
<tr>
<td>---</td>
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<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td><em>Butea monosperma</em></td>
<td>03/09/2018</td>
<td>4177</td>
<td></td>
<td>Agro-forestry nursery</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4</td>
<td><em>Dendrocala mus strictus</em></td>
<td>05/09/2018</td>
<td>4187</td>
<td></td>
<td>Silviculture plantation area</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5</td>
<td><em>Dendrocalala mus strictus</em></td>
<td>03/09/2018</td>
<td>4184</td>
<td></td>
<td>Beside Rest House</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Figures 1-2 Laetiporus sulphureus**: Fruit body growing on living culms of *Bambusa vulgaris* var. yellow

**Figures 3-4 Laetiporus sulphureus**: Fruit bodies attached on stem of *Phyllanthus emblica* at bases
The TFRI campus is spread in 109 ha area with perimeter of 4967m. The fungus, *Laetiporus sulphureus* is distributed in the entire campus area; however its distribution is restricted mainly at 3 sites, the agro-forestry nursery site and silviculture plantation area and in front of the rest house from where the incidence of fungus was recorded. Agro-forestry nursery site is the only site where maximum number of plants was recorded infected (Figure 11). The fungus caused
the maximum damage in *Bambusa vulgaris* var. yellow, 86.7% followed by *Butea monosperma*, 50.0%, however only 2 trees were observed and out of them, 1 was affected. Another species of bamboo, *Dendrocalamus strictus* was recorded least affected (Table 1).

**Discussion**

*Laetiporus sulphureus* is commonly grown on bamboo (both living and dead), oaks, wood hardwoods of *Quercus, Prunus, Pyrus, Populus, Salix, Robinia, Fagus, Ceratonia* and *Eucalyptus* and occasionally on conifers. The species is widely distributed in Europe and North America though may be restricted to east of the Rockies. It grows on dead or mature hardwoods and has been reported from a very wide range of host trees from August to October or later, sometimes as early as June. In the Mediterranean region, this species is usually found on *Ceratonia* and *Eucalyptus*. It can usually be found growing in clusters in Europe and North America (Breitenbach and Kränzlin, 1986; Burdsall Jr. et al., 2001); In India it is reported from Toglo Hills, Sikkim; Sonamarg, Kashmir (Berkeley, 1851c); Nadia and 24-Parganas, West Bengal (Tarafder et al., 2017).

**Conclusion**

Diversity of a macro fungus, *Laetiporus sulphureus* is reported campus of Tropical Forest Research Institute, Jabalpur. It was collected on *Butea monosperma, Dendrocalamus strictus* and *Phyllanthus emblica*. Earlier the species was reported on *Bambusa vulgaris* var. yellow from the same place.
Acknowledgements
The authors are thankful to Dr. G. Rajeshwar Rao, Director, Tropical Forest Research Institute, Jabalpur for providing the research facilities. The work presented here was conducted under project ID No. 224/TFRI/2016/Patho-1(22) funded by Indian Council of Forestry Research & Education (ICFRE), Dehradun.

References


The importance of the forest plants in eco-friendly-anti chemicals activity and their contribution in human welfare

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²Medicinal Plants and Microbiology Research Laboratory Department of Post-Graduate Studies and Research in Botany Gulbarga University, Gulbarga – 585 106, Karnataka, India.

Abstract
The present report reveals the forest plants role in anti chemical activity. The impact of plants can ecofriendly destroys the poisonous content. In the current report a total of 13 plants and their activity on the targeted chemical discussed. Other environment aspects and bioremediation its importance also in detailed discussed. Environment and natural property preservation is vital to the economic growth of any country or a region in many ways but also susceptible to the extent that their utilization, management and sustainability can be affected by performance and deeds of various actions within the society.

Introduction
Environment and natural property preservation is vital to the economic growth of any country or a region in many ways but also susceptible to the extent that their utilization, management and sustainability can be affected by performance and deeds of various actions within the society. Natural resources and environmental issues matters and apprehensions are cross-sartorial but also renders input in every sector in terms of reducing poverty and destitute conditions of people and therefore need to be accorded highest precedence within the overall framework of the Poverty Eradication Action Plan (PEAP) which intends at reducing the fraction of people living in unconditional poverty to a level below 10% by 2017. In view of the cross-cutting nature of environment and normal assets issues, actions to address them require involvement of all relevant sectors. It is from this background that during the PEAP revision in the year 2003, the environment and natural resources PEAP revision sub-committee under the auspices of the then Ministry of Water, Lands and Environment prepared principles for conventional environment and natural resources issues in the PEAP, and other government sectors and programs. He overall objective of these principles was to provide direction and leadership to different sectors on how they can integrate cross cutting environment and natural resources issues in their sectorial preparations and series. He purpose of this research therefore, was to assess the extent to which environment and natural resources issues have been integrated, and propose actions that can accelerate the mainstreaming of environment and natural resources issues in government sectors and programs. Here have been identification of different issues that cause harm to the earth and regular assets; they have been named rustic neediness, populace blast, deforestation, industrialization, uncalled for waste administration, catastrophes and characteristic dangers.
Table 1: Plants in eco-friendly-anti chemicals activity and their contribution in human welfare

<table>
<thead>
<tr>
<th>Sl. No</th>
<th>Scientific name</th>
<th>Common name</th>
<th>Eco-friendly-anti chemicals activity</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Aloe vera</td>
<td>Aloe</td>
<td>Absorbs formaldehyde, benzene</td>
</tr>
<tr>
<td>2</td>
<td>Chlorophytum comosum</td>
<td>Spider plant</td>
<td>Absorbs Formaldehyde, Carbon monoxide, Glycine</td>
</tr>
<tr>
<td>3</td>
<td>Syngonium podophyllum</td>
<td>Wiping pig plant</td>
<td>Absorbs Formaldehyde, benzene, Trichloro-ethylene</td>
</tr>
<tr>
<td>4</td>
<td>Aglaonema spp</td>
<td>Chinese evergreen plant</td>
<td>Reduces environment pollution</td>
</tr>
<tr>
<td>5</td>
<td>Dracaena marginata</td>
<td>Red edged plant</td>
<td>Absorbs Formaldehyde, Glycine, Trichloro-ethylene</td>
</tr>
<tr>
<td>6</td>
<td>Sansevieria spp</td>
<td>Hard leaf plant</td>
<td>Absorbs Formaldehyde</td>
</tr>
<tr>
<td>7</td>
<td>Ficus elastica</td>
<td>Rubber plant</td>
<td>Absorbs Formaldehyde</td>
</tr>
<tr>
<td>8</td>
<td>Sansevieria trifasciata</td>
<td>Snake plant</td>
<td>Absorbs Formaldehyde, washrooms soap, shampoos pollution reduces.</td>
</tr>
<tr>
<td>9</td>
<td>Spathiphyllum wallisii</td>
<td>Peace lily</td>
<td>Absorbs Formaldehyde, benzene, Trichloro-ethylene</td>
</tr>
<tr>
<td>10</td>
<td>Pothos spp</td>
<td>Pothus plant</td>
<td>Inactivates Formaldehyde</td>
</tr>
<tr>
<td>11</td>
<td>Hedera helix</td>
<td>English Ivey plant</td>
<td>Animal produced bacteria will be destroyed.</td>
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<tr>
<td>12</td>
<td>Euphorbia tirucalli</td>
<td>Kalli plant</td>
<td>Misquotes repellent</td>
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<tr>
<td>13</td>
<td>Abilmascus eaculentum</td>
<td>Cucumber</td>
<td>Antimicrobial activity</td>
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</table>

Methods for determination of phytoremediation

Phytoextraction (Phytoaccumulation)

Phytoextraction, the use of plants to remove contaminants from soil by accumulation of contaminants in plant tissue, is a promising cleanup technology for a variety of metal-containing soils. However, hytoextraction of high specific activity radionuclides such as 137Cs or 90Sr is a challenge because of the very low molar reconcentrations of the radionuclide in soil (typically in the order of 10^-12 mol/kg) compared with much higher eficie concentrations of stable elements naturally present in soil. In addition, plant uptake of 137Cs and 90Sr can be inhibited by competition with K and Ca, respectively. Further, the prospect of phytoextraction of 137Cs from contaminated soil is minimized because sorption of Cs into interlayer spaces on mica–illite minerals appears to be highly specific and poorly reversible. Many metals such as Zn, Mn, Ni, and Cu are essential micronutrients. In common nonaccumulator plants, accumulation of these micronutrients does not exceed their metabolic needs (<10 ppm). In contrast, metal hyperaccumulator plants can accumulate exceptionally high amounts of metals (in the thousands of ppm). Hyperaccumulator plants do not only accumulate high levels of essential micronutrients, but can absorb significant amounts of nonessential metals, such as Cd. Heavy metal absorption is governed by soil characteristics such as pH and organic matter content. Thus, high levels of heavy metals in the soil do not always indicate similar high concentrations in plants. The extent of accumulation and toxic level will
depend on the plant and heavy metal species under observation. Most abandoned waste dump sites in many towns and villages in Nigeria attract people as fertile ground for cultivating varieties of crops. According to Alloway, plants grown on soils contaminated with heavy metal concentration have increased heavy metal ion content due to pollution. The cultivated plants take up the metals either as mobile ions present in the soil solution through the roots or through foliar adsorption.

**Rhizofiltration:**
Rhizofiltration is similar in concept to Phytoextraction but is concerned with the remediation of contaminated groundwater rather than the remediation of polluted soils. The contaminants are either adsorbed onto the root surface or are absorbed by the plant roots. Plants used for rhizofiltration are not planted directly in situ but are acclimated to the pollutant first. Plants are hydroponically grown in clean water rather than soil, until a large root system has developed. Once a large root system is in place the water supply is substituted for a polluted water supply to acclimatise the plant. After the plants become acclimatised they are planted in the polluted area where the roots uptake the polluted water and the contaminants along with it. As the roots become saturated they are harvested and disposed of safely. Repeated treatments of the site can reduce pollution to suitable levels as was exemplified in Chernobyl where sunflowers were grown in radioactively contaminated pools.

**Phytostabilisation**
Phytostabilisation is the use of certain plants to immobilize soil and water contaminants. Contaminant are absorbed and accumulated by roots, adsorbed onto the roots, or precipitated in the rhizosphere. This reduces or even prevents the mobility of the contaminants preventing migration into the groundwater or air, and also reduces the bioavailability of the contaminant thus preventing spread through the food chain. This technique can also be used to re-establish a plant community on sites that have been denuded due to the high levels of metal contamination. Once a community of tolerant species has been established the potential for wind erosion (and thus spread of the pollutant) is reduced and leaching of the soil contaminants is also reduced.

**Phytoremediation of organic polluted sites**

**Phytodegradation** *(Phytotransformation)*
Phytodegradation is the degradation or breakdown of organic contaminants by internal and external metabolic processes driven by the plant. *Ex planta* metabolic processes hydrolyse organic compounds into smaller units that can be absorbed by the plant. Some contaminants can be absorbed by the plant and are then broken down by plant enzymes. These smaller pollutant molecules may then be used as metabolites by the plant as it grows, thus becoming incorporated into the plant tissues. Plant enzymes have been identified that breakdown ammunition wastes, chlorinated solvents such as TCE (Trichloroethane), and others which degrade organic herbicides.

**Rhizodegradation**
Rhizodegradation (also called enhanced rhizosphere biodegradation, phytostimulation, and plant assisted bioremediation) is the breakdown of organic contaminants in the soil by soil dwelling microbes which is enhanced by the rhizosphere's presence. Certain soil
dwelling microbes digest organic pollutants such as fuels and solvents, producing harmless products through a process known as Bioremediation. Plant root exudates such as sugars, alcohols, and organic acids act as carbohydrate sources for the soil microflora and enhance microbial growth and activity. Some of this compound may also act as chemotactic signals for certain microbes. The plant roots also loosen the soil and transport water to the rhizosphere thus additionally enhancing microbial activity.

**Phytovolatilization**
Phytovolatilization is the process where plants uptake contaminants which are water soluble and release them into the atmosphere as they transpire the water. The contaminant may become modified along the way, as the water travels along the plant's vascular system from the roots to the leaves, whereby the contaminants evaporate or volatilize into the air surrounding the plant. There are varying degrees of success with plants as phyto volatilizes with one study showing poplar trees to volatilize up to 90% of the TCE they absorb.

**Advantages of phytoremediation compared to classical remediation**
It is more economically viable using the same tools and supplies as agriculture. It is less disruptive to the environment and does not involve waiting for new plant communities to decolonize the site. Disposal sites are not needed. It is more likely to be accepted by the public as it is more aesthetically pleasing than traditional methods. It avoids excavation and transport of polluted media thus reducing the risk of spreading the contamination. It has the potential to treat sites polluted with more than one type of pollutant. It is dependent on the growing conditions required by the plant (i.e. climate, geology, altitude, temperature). Large scale operations require access to agricultural equipment and knowledge. Success is dependent on the tolerance of the plant to the pollutant. Contaminants collected in senescing tissues may be released back into the environment in autumn. Contaminants may be collected in woody tissues used as fuel. Time taken to remediate sites far exceeds that of other technologies. Contaminant solubility may be increased leading to greater environmental damage and the possibility of leaching.

**CONCLUSION**
Due to the rapid enhancement of population and chemicals utilization for their daily uses can causes hazardous to the human health and anti environment impacts. So that some of the natural plants can perform the ecofriendly absorption of the chemicals and balance the environment and human health. So the present report discloses the afforest plants role in anti chemical activity. The impact of plants can ecofriendly destroys the poisonous content. In the current report a total of 13 plants and their activity on the targeted chemical discussed. Other environment aspects and bioremediation its importance also in-detailed discussed. The present results give fundamental aspects to the upcoming researchers in this area.

**Reference**


हानिकारक खरपतवारः प्रबंधन एवं नियंत्रण

ममता पुरोहित, योगेश पारदी एवं राजेश कुमार मिश्रा

उपर्युक्त वाणिज्य वन अनुसंधान संस्थान
(भारतीय वाणिज्य अनुसंधान एवं शिक्षा परिषद, पर्यावरण, वन और जलवायु परिवर्तन मंत्रालय, भारत सरकार)

खरपतवार ऐसे अवास्तव गैरहृदय वाले वन्य जीवों को खतरा लगातार करते हैं। इसलिए, नियंत्रण और प्रबंधन करना महत्वपूर्ण है। खरपतवार (Lantana camara) विभीशित जंगली खरपतवारों में से एक है।

इस वन्यजीव खरपतवार का प्रवाद साथ-साथ भरपूर पत्ते और शांति समुदाय को भी प्रभावित करते हैं। इसलिए, इसका नियंत्रण और प्रबंधन बहुत महत्वपूर्ण है।

ईस्पाती (Avena fatua), चट्टान कपूर (Calotropis procera), ओक्सीकांता (Carthamus oxyacantha), चिवा (Cyperus rotundus), बुर्जताहर (Euphorbia hirta), बुर्जताहर रंगीन (Euphorbia hypericifolia) और आकर (Lantana camara) दूसरे खरपतवारों के साथ इस्तेमाल करने पर अधिक प्रभावी और किसानों के लिए महत्वपूर्ण है।

Lantana camara (टनटती, फुल्लकरी, कुरी)

हानिकारक खरपतवार प्रजातियों

कुछ हानिकारक खरपतवार प्रजातियों के नाम निम्नलिखित हैं।

Avena fatua (जंगल जड़ी)
Calotropis procera (आक, मदर)
Carthamus oxyacantha (कंदियारी)
Cyperus rotundus (मानटोना)
Euphorbia hirta (बड़ी दूधी)
Euphorbia hypericifolia (दूधिया)
Lantana camara (टनटती, फुल्लकरी, कुरी)
5. गांठा फसल पर प्रभाव
इस फसल में शर्करा का प्रतिशत कम हो जाता है।

6. साम-सब्जियों पर प्रभाव
साम-सब्जियों के स्वाद में कमी आ जाती है एवं अन्य पीविष्क गुणों का हाम हो जाता है।

7. हुरा चारा पर प्रभाव
हुरा चारा उत्पादन में कमी आ जाती है एवं हुरे चारे का स्वाद बिगड़ जाता है।

8. नट्रजन स्थिरीकरण पर प्रभाव
विभिन्न खरपत्वर नाशी रसायनों के लगातार उपयोग से उन कृषि व वाणिज्य प्रजातियों में जनजीवित को पानी जानवरी ग्रंथियों में नट्रजन स्थिरीकरण करने वाले बैकटियरिया होते हैं, जिन्हें ग्रंथियों की संख्या एवं भार में कमी आ जाती है। फलतः नट्रजन स्थिरीकरण का प्रभाव भारी होता है एवं नट्रजन की कमी से पैदा का नट्रजन कम हो जाता है।

9. पैदावार पर प्रभाव
खरपत्वरों के कारण फसलों के उत्पादन में 30 से 40 प्रतिशत की कमी आ जाती है तथा गुणवत्ता का हाम होता है। पैदावार में होनेवाली कमी फसलों के प्रकार, बीज बोने से फसल पकने का समय, पौधों की ऊँचाई तथा पौधों के फैलाव पर निर्भर होती है।

10. कृषि यंत्रों पर प्रभाव
खरपत्वर युक्त बेंगों में कृषि कार्यों के दौरान यंत्रों तथा मशीनों का कार्यक्षमता घट जाती है तथा दूर-दूर आदि होने से उनकी आय भी घट जाती है।

11. मानव समुदाय पर प्रभाव
खरपत्वरों जैसे जानवर घाम आदि के कारण मनुष्य में लध्वा एवं श्रस्न संबंधी बीमारियों हो जाती हैं।

12. पालतू पशुओं पर प्रभाव
हांथ द्वारा खरपतवार नियंत्रण

प्रतिबंधात्मक विधियाँ
1. खरपतवार रहित बीजों का उपयोग करना।
2. खरपतवार रहित शुद्ध बीज दोनों।
3. प्रक्षेत्र का उत्तम प्रबंधन।
4. कृषि में उपयोग आनेवाले यंत्रों एवं मशीनों की समय-समय पर साफ-सफाई एवं विस्फोटक करना।
5. प्रक्षेत्र में अबूदी प्रक्षेत्र की सही-सही गोदार खाद व अन्य कार्बनिक खादों का प्रयोग करना।
6. सिंचाई की नालियों व नहरों के किनारे ऊर्जा के रूप में खरपतवारों की नष्ट करना।
7. खेत एवं खेती की सीमाओं से खरपतवारों को निकालना।
8. गर्मियों के दौरान प्रक्षेत्र की गहरी जुताई करना।
9. शुष्क प्रक्षेत्रों वाले खेतों से समय-समय पर खरपतवार निकालते रहना।
10. पशुओं को ऐसे स्थानों से न गजरने देना जहां पर खरपतवार ऊग रहे हों।
शाकनाशक का चिह्नकार

नियंत्रण विधियों

1. यंगों एवं मशीनों द्वारा खरपतवारों की प्रजाति एवं संपन्नता के आधार पर यंगों एवं मशीनों की सहायता से खरपतवार नियंत्रण किया जा सकता है।

2. हाथों द्वारा घर के भीतर, आगन्तुकों, रोपणी आदि में ऊँची हुई खरपतवारों को हाथ से चुनकर निकाला जा सकता है।

3. निंदाई-मुड़ाई इसमें खरपतवारों को नष्ट करने के लिए गुरुपी, फाला, गैंडी आदि का प्रयोग किया जाता है।

4. खरपतवारों की कटाई इसमें चारागाहों व लान आदि से खरपतवारों की बार-बार कटाई की जाती है जिससे खरपतवारों के विभिन्न अंगों में एकत्रित भोज्य पदार्थों का भंडारण समाप्त हो जाता है और खरपतवार नष्ट हो जाते हैं।

5. कृत्रिम आवरण (मल्लिग का प्रयोग) द्वारा खरपतवारों का कृत्रिम आवरण के द्वारा बायु एवं प्रकाश से संबंध तोड़ दिया जाता है जिससे खरपतवार नष्ट हो जाते हैं। कृत्रिम आवरण के लिए भूसा, सूखी पत्तियाँ, लकड़ी का बुरादा आदि का प्रयोग करते हैं।

6. जल मस्तन्दा द्वारा इस विधि में खरपतवारों को जलमग्र रखते हैं जिससे भूसन क्रिया सुचारू रूप से न होने के कारण वे नष्ट हो जाते हैं।

7. आग द्वारा बहुपर्य खरपतवारों को अधिकांश आग लगाकर नष्ट किया जाता है।

8. शस्य विधि द्वारा फसल चर्च में परिर्वतन कर तथा फसलों को विभिन्न प्रकार से उपानक खरपतवारों को नष्ट करने की विधि का शस्य विधि कहते हैं। इस विधि में खरपतवारों का नियंत्रण फसल चर्च का उपयोग, बीज बोने का समय, बीज का मात्रा, कटारों से कटारों की दूरी तथा कटार में पौधों की दूरी एवं फसलों के ज्यादा आदि द्वारा किया जाता है।

9. शाक नाशियों द्वारा कभी-कभी खरपतवारों को पूर्णतः नष्ट करने के लिए उनकी वृद्धि को रोकने के लिए खरपतवार नाशक रसायनों (शाकनाशी) का उपयोग किया जाता है।

एकीकृत खरपतवार प्रबंधन एवं नियंत्रण एकीकृत खरपतवार प्रबंधन की एक महत्त्वपूर्ण घटक है तथा परिर्वतन, सार्वजनिक स्वास्थ्य एवं लाभकारी जीवन के ठीकम रखने की प्रवृत्ति करता है जिससे इन प्रकार के प्रभाव न पड़े एवं द्वीपकालिक प्राकृतिक समाधान प्राप्त हो सके। एकीकृत खरपतवार प्रबंधन विभिन्न तकनीकियों एवं उद्योग नियंत्रण, प्राकृतिक वात परिवर्तन, कृत्रिम प्रणाली में सुझाव, प्रतिरोधी क्रियाओं का प्रयोग आदि के समाप्ती के लिए केंद्रित है तथा खरपतवारों का नियंत्रण करने के लिए
रासायनिक शाक्तिशाली पर निर्भरता को कम करता है।
खरपतवार प्रबंधन एवं नियंत्रण के लिए आवश्यक है कि एक ही नियंत्रण विधि को न अपनाकर एकीकृत समन्वित खरपतवार नियंत्रण एवं प्रबंधन प्रणाली का उपयोग करना चाहिए जिससे फसल प्रजातियों एवं मृदा पर हानिकारक प्रभाव न पडे। यदि उपर्युक्त बातों को ध्यान में रखा जाये तो नये प्रक्रियाओं में खरपतवारों का प्रसार या संक्रमण रोका जा सकता है।