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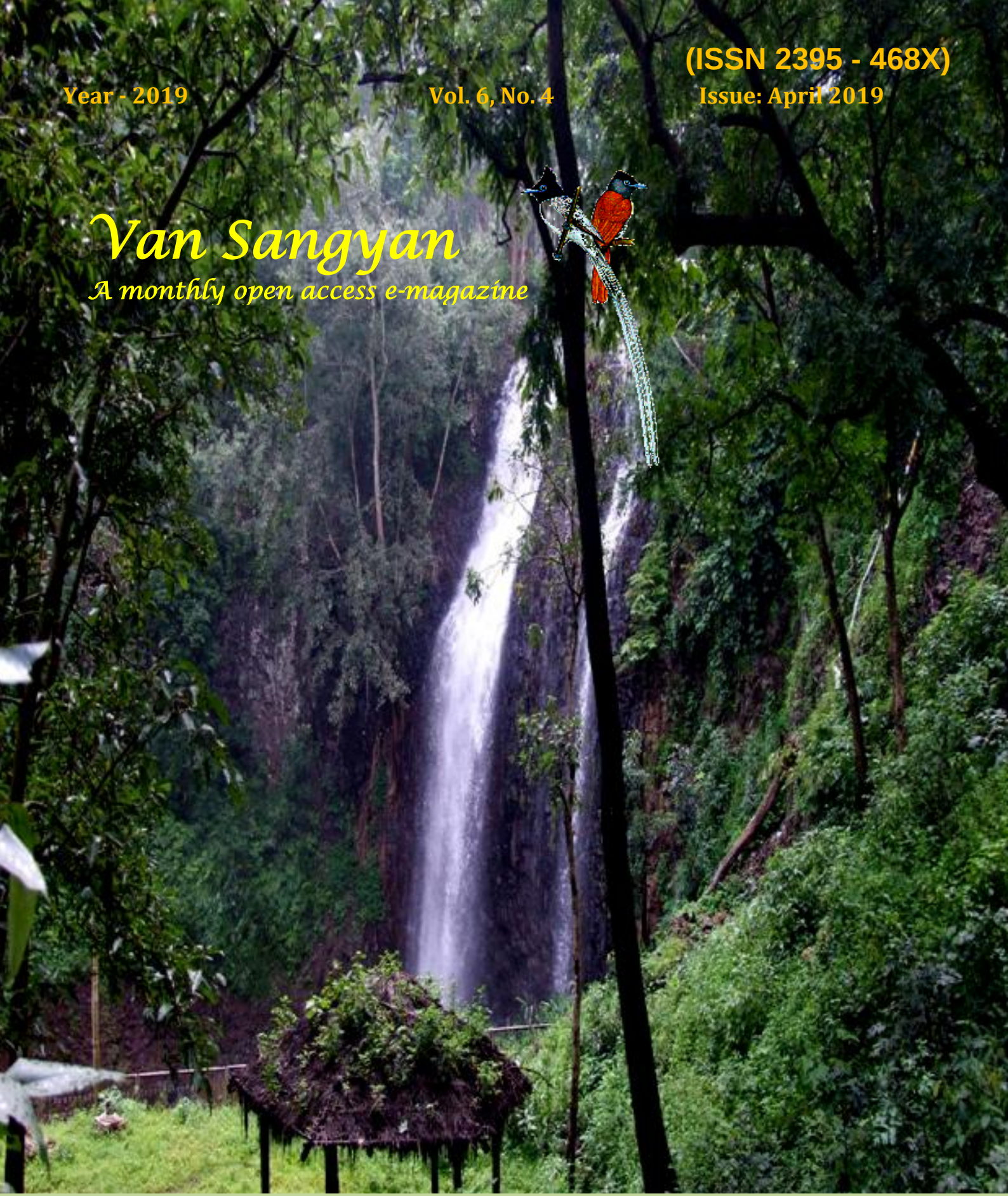

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Van Sangyan

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

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 landbase 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 provid

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 खरपतवार: 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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Diversity and distribution of Lichens in Tripura

Poulami Saha[1], Sandeep Yadav[2], Pawan K Kaushik[1]

[1]Forest Research Centre for Livelihood Extension (FRC-LE)
(Indian Council of Forestry Research & Education, Ministry of Environment, Forests and Climate Change, Govt. of India)
Agartala
[2]Forest 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 ofBiodiversity. 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 type 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 inmost 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 proposedtransmission 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:

Sl. No.	Types of forests	Code	Area in km^2
1	East Himalayan Lower Bhabar Sal	I/I/3/3C/CIb	87.77
2	Cachar Tropical Evergreen Forests	I/I/IB/C3	150.94
3	Moist Mixed Deciduous Forests	I/I/3/3C/C3	550.28
4	Low Alluvial Savannah Woodland	I/I/3/3C/ISI	1316.82
5	Moist Mixed Deciduous Forests / Dry Bamboo Brakes	I/I/3C/2SI	1230.04
6	Secondary Moist Bamboo Brakes	I/I/2/2B/2SI	397.09
	Total		3732.94

(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

1	Forest Area	6294.287 Sq km.
2	% of forest area to geographical area :	60. 02%
3	Reserve Forest	3588.183 sq km.

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

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

7	Unokuti	376.739	6.0	Dense Forest
8	Khowai	587.224	9.4	Moist Mixed Deciduous Forests
	Total	**6294.287**	**100**	

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

Sl.No	Name of the sanctuary	Area in Sq Km
1	Sepahijala Wildlife Sanctuary	18.540
2	Gumti Wildlife Sanctuary	389.540
3	Trishna Wildlife Sanctuary	194.710
4	Roa Wildlife Sanctuary	0.860
	Total	**603.650**

Materials and methods

Strudy 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 bark, twigs and stems from the forest floor with well-colonized lichens. Specimens were collected inpaper 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 plotit has been registered the altitude and the geographic coordinates for sample collection.

Results

Lichen Survey:

Table 5: Forest ranges covered during the Lichen Survey

Sl.No	District	Ranges/ Subdivision/ WLS	No of lichen samples collected	Forest types	Associated host
1	**North Tripura District**	Kanchanpur Subdivision	25	Mixed evergreen	Plant Bark, Soil
		Choraibari Forest Range	10		Plant Bark
2	**Unakoti District**	Kumarghat Subdivision	19	Dense Forest	Plant Bark, dried twig
		Kailashahar range	10		Plant Bark
		Pecharthal range	11		Plant Bark
		Machmara range	5		Plant Bark
3	**Dhalai Tripura District**	Longthorai Valley	11	Mixed Moist Forest	Plant Bark, Soil, Rock
		Ambassa	14		Plant Bark, dried twig
4	**Khowai Tripura District**	Khowai	8	Moist Mixed Deciduous Forests	Plant Bark, twig, Plant leaf
		Teliamura	19		Plant Bark, twig, Plant leaf
		Baramura range	16		Plant Bark, twig,
5	**West Tripura District**	Mohanpur Subdivision	8	Mixed Forest	Plant Bark
		Hezamara Forest range	9		Plant Bark
		Champaknagar Mandai Forest range	16		Plant Bark, plant leaf
		Gandhigram Forest Range	18		Plant Bark
		Nagicherra Forest Range	5		Plant Bark
6	**Sepahijala**	Bishalgarh range	8	Mixed Forest	Plant Bark, soil
		Jampuijala forest range and	11		Plant Bark
		Melaghar forest range,Sonamura Subdivision	17		Plant Bark, leaf part, soil
7	**Gomati District**	Udaipur Subdivision	13	Tropical Evergreen Forests	Plant Bark
		Dumbur,Amarpur range	24		Plant Bark, dried twig, leaf part, soil, rock, Bamboo

					shoot
		Karbook range	9		Plant Bark, dried twig, leaf part
		Gomuti Wild life Sanctuary	23		Plant Bark, dried twig, leaf part, soil.
8	**South Tripura District**	Belonia Kakulia Range	8	Dense forest	Plant Bark
		Trishna Wild Life Santuary	23		Plant Bark, dried twig, leaf part
		Santirbazar Muhuripur Range	8		
		Manubazar Satchand range	10	Tropical Evergreen Forest	
		Amlighat Sabroom range	12		Plant Bark, dried twig, leaf part
		Srinagar Sabroom range	8		
		Total	**378**		

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)

Districts	No of samples collected
North Tripura District	35
Unakoti District	45
Dhalai Tripura District	25
Khowai Tripura District	43
West Tripura District	56
Sepahijala	36
Gomati District	69
South Tripura District	69
Mean	47.25
SD	16.11344

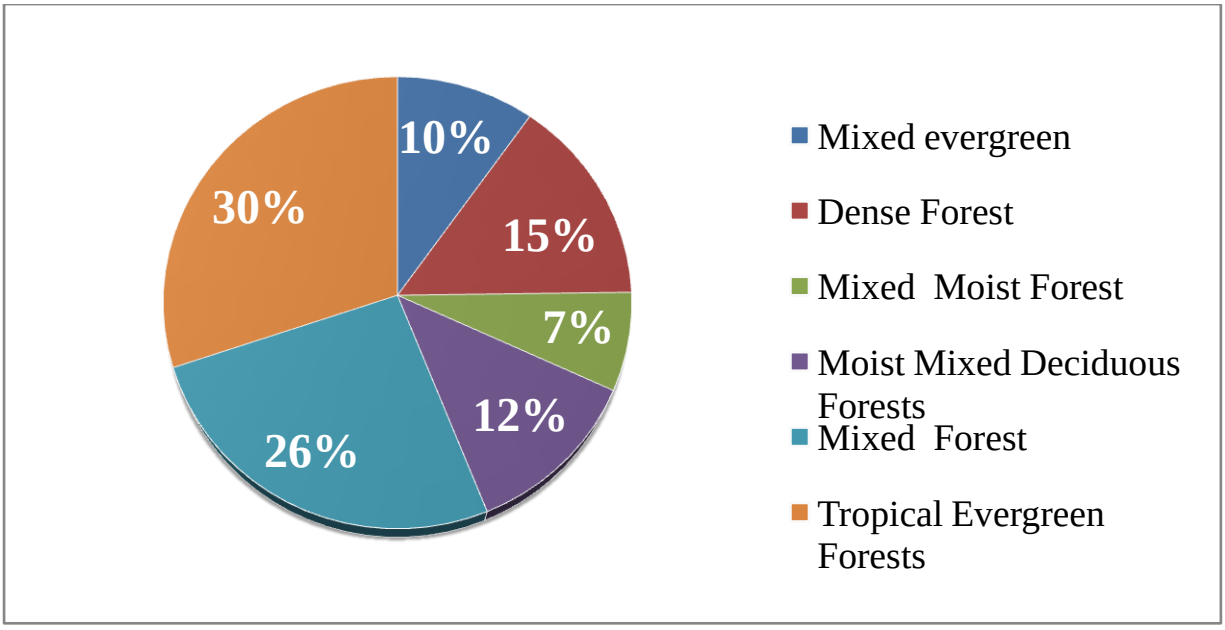

Figure 1: Percentage wise distribution of collected lichen samples from different forest types of Tripura (till date)

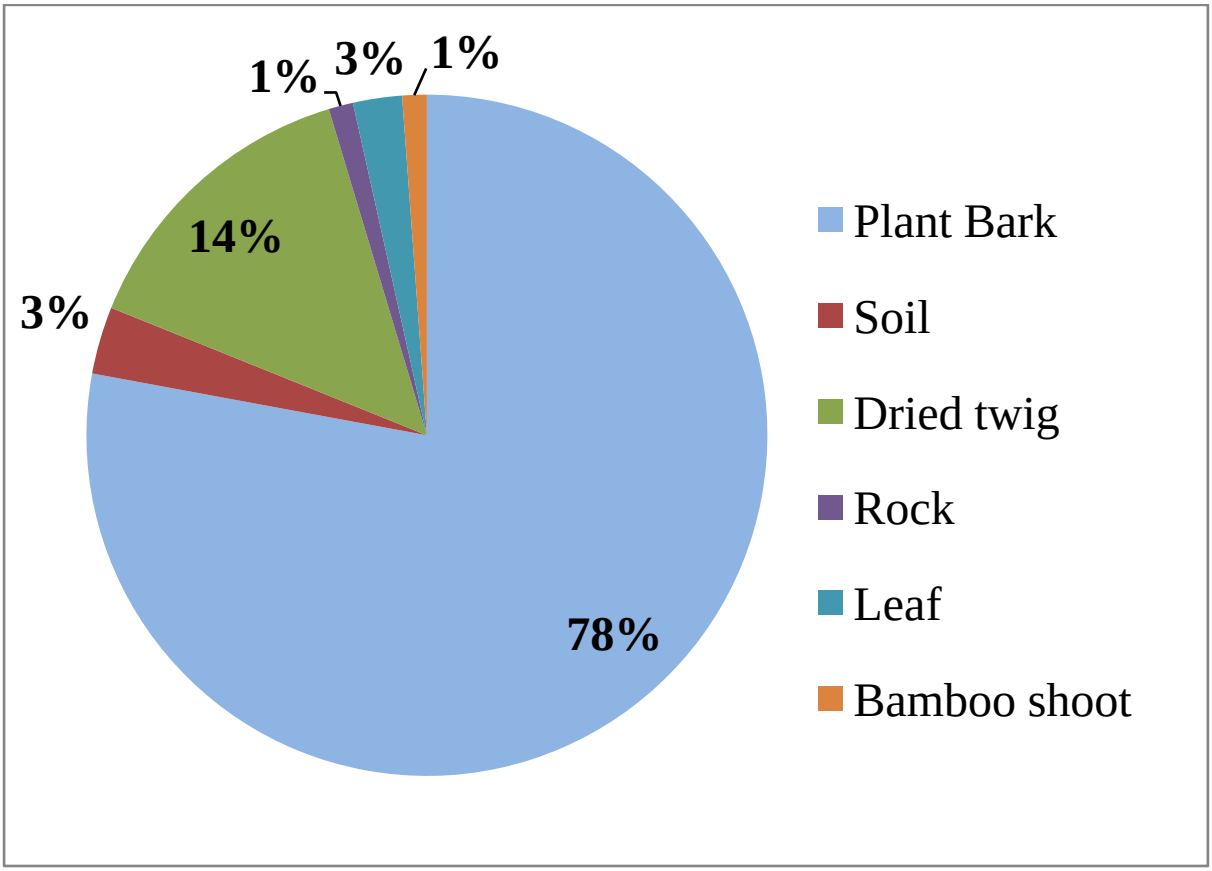

Figure 2: Percentage wise distribution of lichen samples collected from different hosts

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 aseries of environmental parameters (namely light, air humidity, UV-B radiation, temperature, andairborne chemicals such as SO2 and NOx making them useful indicators for air pollution and climatechange (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 mycobiant 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

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

C.A. Dholariya, M. Sukhadiya, L.K. Behera, A.A. Mehta, D. Nayak and S.M. Patel
College of Forestry, Navsari Agricultural University, Navsari- 396 450
Email- chintanforestry@gmail.com

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). Baptigenin 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 ap-thane. 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.

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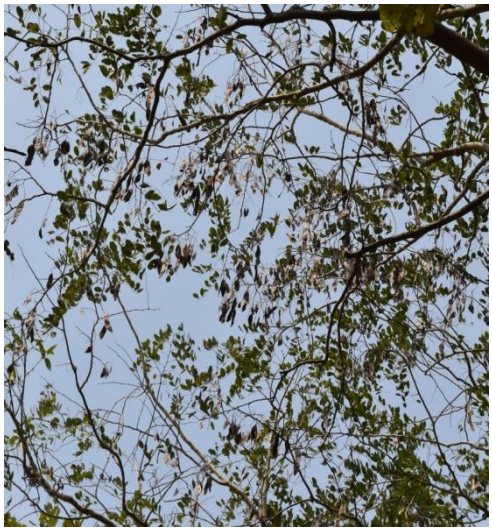
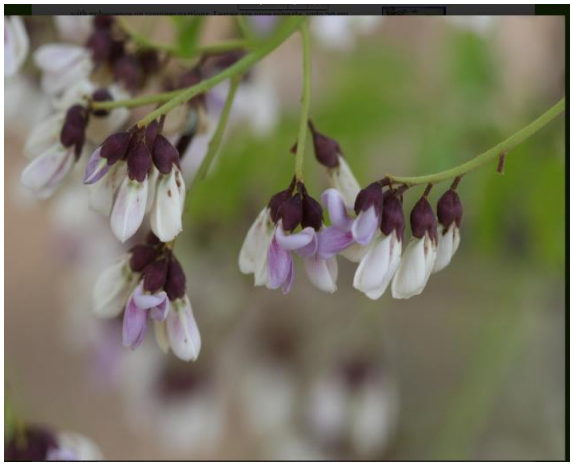
Photographs of *Dalbergia lanceolaria*

Tree



Leaves



Flowers

Fruits

Seeds

Bark

Prospective of lesser known tree species: Malabar orchid (*Bauhinia malabarica* Roxb.)

Madhuri Sukhadiya, C.A. Dholariya, L.K. Behera, A.A. Mehta, P.K. Shrivastava and S.M. Patel

College of Forestry, Navsari Agricultural University, Navsari- 396 450

Email- chintanforestry@gmail.com

Introduction

Bauhinia malabarica Roxb., popularly known as 'Malabar orchid or Mounatain 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.

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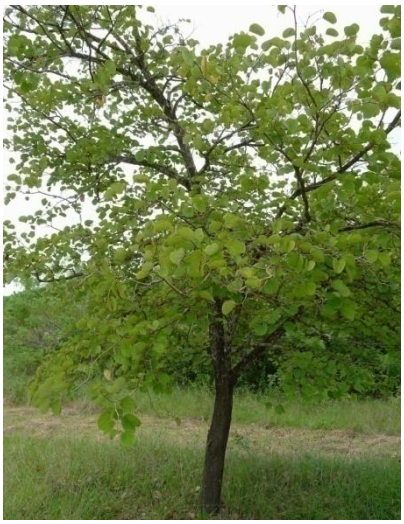
Photographs of *Bauhinia malabarica*



Tree

Leaves

Flowers

Fruits

Seeds

Bark

Utilization and silviculture of a lesser known tree species: *Sterculia villosa* Roxb.

C.A. Dholariya, Madhuri Sukhadiya, L.K. Behera, B.S. Desai, S.A. Huse and A.A. Mehta

College of Forestry, Navsari Agricultural University, Navsari- 396 450

Email- chintanforestry@gmail.com

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 tomnentosa* 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-

Leaf fall	Leaf renewal	Flowering period	Fruiting period
December to April	May to June	February to March	March to June

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.

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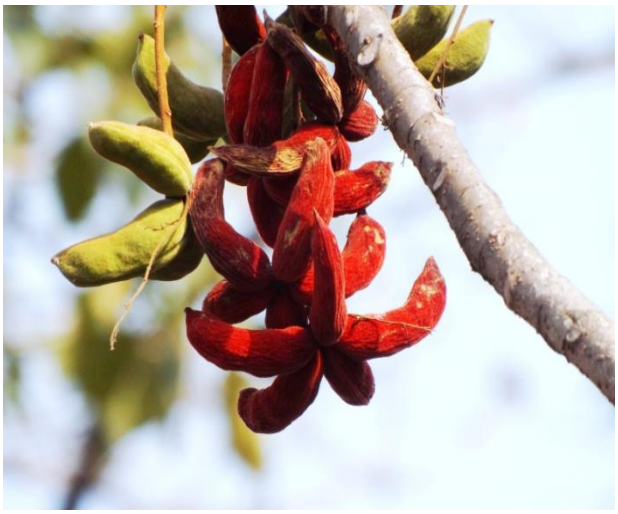
Photographs of *Sterculia villosa*

Tree

Bark

Flowers

Leaves



Fruits

Seed

Trees outside forest (TOF) in urban environment of Sarguja

Manika Uraon, Manoj Kumar Jhariya and Dhiraj Kumar Yadav

Department of Farm Forestry
Sant Gahira Guru Vishwavidyalaya
Sarguja, Ambikapur-497001 (C.G.), INDIA
Email: manu9589@gmail.com

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 contributes 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). Therefore, present study was carried out to assess the TOF in urban environment of Sarguja.

Materials and methods

The present study was conducted in Ambikapur, Sarguja district of Chhattisgarh. Chhattisgarh is a state in central India and have about 41.18% of the geographical area under various types of forests (FSI, 2011). Out of total 27 districts, Sarguja is one of the major district of Chhattisgarh which represented by very rich biological diversity (Sinha *et al*., 2014 & 2015; Yadav *et al*., 2015; Jhariya and Yadav, 2016). It lies between 22^0 58' to 23^0 49' N latitude and 81^0 33' to 82^0 45' E longitude. The average elevation of the area varies from 600 meter and above. The climate of district is characterized by hot summer and well distributed rainfall during the monsoon season. The mean monthly temperature ranges between 15.34 ^{0}C (January) and 31.54 ^{0}C (May) and the mean annual temperature averages 23.31 ^{0}C. The average annual rainfall is 1161.42 mm (Sinha *et al*., 2015).

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 occurance. 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 represent 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 *Termanilia 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

Family	Common Name	Botanical name	Uses/Part Use
Anacardiaceae	Mango	*Mangifera indica* (E,W)	Fruit, Economic value, fuel wood
Annonaceae	Sheetaphal	*Annona squamosa* (E,W)	Edible fruit, medicinal value
	False Ashok	*Polyalthia longifolia* (E,W)	Medicinal value
Apocynaceae	Saptpardi	*Alstonia scholaris* (E,W)	Medicinal value
	Kaner	*Nerium indicum* (E,W)	Medicinal value
Bixaceae	Sinduri	*Bixa orellana* (E,W)	Seed
Bombacaceae	Semal	*Bombax ceiba* (E,W)	Medicinal value
Combretaceae	Arjun	*Terminalia arjuna* (E,W)	Medicinal, Silk host
	Bahera	*Terminalia bellerica* (E)	Medicinal value
	Harra	*Terminalia chebula* (E)	Medicinal value
Dipterocarpaceae	Sal	*Shorea robusta* (E,W)	Gum, Timber wood
Euphorbiaceae	Amla	*Emblica officinalis* (E,W)	Edible fruit, timber wood, medicinal
	Rattanjot	*Jatropha carcus* (E,W)	Making biofuel, Live fence
	Castor	*Ricinus communis* (E,W)	Medicinal value, Oil
Lamiaceae	Teak	*Tectona grandis* (E,W)	Timber wood
Leguminaceae	Sisham	*Dalbergia sissoo* (E,W)	Timber, medicinal value
	Gulmohar	*Delonix regia* (W)	Medicinal value
	Karanj	*Pongamia pinnata* (E,W)	Seed, Medicinal value
	Coco tamarind	*Samanea saman* (E)	Seed,
	Babul	*Acacia nilotica* (E,W)	Gum, Small timber, fodder
	Siris	*Albizia spp.* (E,W)	Medicinall, timber wood
	Kachnar	*Bauhinia spp.* (E,W)	Medicinal value
	Amaltas	*Cassia fistula* (E,W)	Fuel wood
	Kasaud	*Cassia siamea* (E)	Medicinal value, small timber
	Ashok	*Saraca indica* (E,W)	Medicinal value
	Imli	*Tamarindus indica* (E,W)	Fuel wood, fruit, medicinal
Malvaceae	Golden shower	*Ceiba pentandra* (E)	Seed, Fibre, Medicinal
	Gudhal	*Hibiscus rosa sinensis* (E,W)	Medicinal value, religious
Meliaceae	Neem	*Azadirachta indica* (E,W)	Medicinal value, timber wood
	Bachain	*Melia azedarach* (E,W)	Medicinal value
Moraceae	Bargad	*Ficus benghalensis* (E,W)	Religious importance
	Goolar	*Ficus glomerata* (W)	Fruit, Medicinal value
	Pipal	*Ficus religiosa* (E,W)	Religious importance, fodder

Moringaceae	Munga	*Moringa oleifera* (E,W)	Medicinal value, Vegetable
Musaceae	Banana	*Musa paradisiaca* (E,W)	Fruits, All part
Myrtaceae	Guava	*Psidium guajava* (E,W)	Fruit & fuel wood
	Jamun	*Syzygium cumini* (E,W)	Fruit, Fuel wood
Punicaceae	Anar	*Punica granatum* (E)	Fruit
Rhamnaceae	Ber	*Ziziphus mauritiana* (E,W)	Fruit, fodder, firewood
Rubiaceae	Kadam	*Anthocephalus cadamba* (E)	Medicinal, wood
Rutaceae	Bel	*Aegle marmelos* (E,W)	Medicinal value, Fruit, religious
	Kagji Nibu	*Citrus limonia* (E)	Fruit, Medicinal
	Mithineem	*Murraya koenigii* (E,W)	Medicinal, Add flavours in foods
Sapindaceae	Litchi	*Litchi chinensis* (E)	Fruit, Medicinal use
Sapotaceae	Mahua	*Madhuca indica* (E)	Flower, Fruit, Medicinal
Verbenaceae	Khamhar	*Gmelina arborea* (E,W)	Timber and fuel wood

Table 2: Status of TOF in different locality of Bauripara site (East Aspect) of Sarguja

Species	Home Stead	Road side	B/W Road	Institution	Near Pond	Drain line	Private Land	Others
Acacia nilotica	√	√	√	√		√		√
Aegle marmelos	√	√		√	√		√	
Albizia spp.		√						
Alstonia scholaris		√	√				√	√
Anthocephalus cadamba	√	√		√	√	√		
Annona squamosa	√	√		√	√	√		√
Azadirachta indica	√	√	√	√		√	√	
Bauhinia spp.	√	√						√
Bixa orellana	√			√				
Bombax ceiba		√					√	
Cassia fistula				√	√		√	
Cassia siamea		√	√		√		√	√
Ceiba pentandra		√						√
Dalbergia sissoo	√	√		√		√	√	
Hibiscus rosa sinensis	√							√
Jatropha carcus		√	√		√		√	
Mangifera indica	√	√		√	√			√
Psidium guajava	√	√		√		√	√	
Pongamia pinnata		√	√	√	√		√	
Polyalthia longifolia		√						
Ziziphus mauritiana	√					√		√

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

Species	Home Stead	Road side	B/W Road	Institution	Near Pond	Drain line	Private Land	Others
Acacia nilotica					√	√		

Azadirachta indica	√	√	√	√	√	√		
Gmelina arborea	√	√		√			√	
Hibiscus rosa sinensis		√						√
Jatropha carcus		√	√		√	√		
Mangifera indica	√	√	√	√	√	√	√	√
Melia azedarach							√	
Moringa oleifera		√						
Murraya koenigii				√			√	√
Musa Paradisiaca								√
Nerium indicum							√	
Psidium guajava	√	√	√	√	√	√		√
Polyalthia longifolia		√			√			
Pongamia pinnata	√	√	√	√		√		
Ricinus communis						√		
Samanea saman	√							√
Shorea robusta		√						√
Syzygium cumini				√			√	
Tamarindus indica	√	√		√	√		√	√
Tectona grandis				√			√	
Terminalia arjuna		√						
Ziziphus mauritiana	√				√			√

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

Species	Home Stead	Road side	B/W Road	Institution	Near Pond	Drain line	Private Land	Others
Acacia nilotica		√	√	√	√		√	
Aegle marmelos		√		√				√
Annona squamosa	√						√	
Azadirachta indica	√	√		√	√			√
Citrus limonia		√		√				
Dalbergia sissoo		√					√	
Emblica officinalis	√			√	√			√
Ficus benghalensis		√			√		√	
Ficus religiosa		√			√	√	√	√
Litchi chinensis	√						√	
Madhuca indica		√					√	√
Mangifera indica	√	√		√			√	√
Pongamia pinnata		√	√			√		√
Punica granatum							√	
Saraca indica	√		√	√			√	
Shorea robusta							√	√
Tamaridus indica		√					√	
Termanilia arjuna		√		√		√		
Termanilia bellerica	√							
Termanilia chebula				√			√	
Ziziphus mauritiana		√				√	√	

Table 5: Status of TOF in Ajirma site of West Aspect of Sarguja

Species	Home Stead	Road side	B/W Road	Institution	Near Pond	Drain line	Private Land	Others
Acacia nilotica		√	√				√	
Annona squamosa	√			√	√	√		
Azadirachta indica				√	√			
Bauhinia spp.	√							
Bombax ceiba		√		√			√	
Dalbergia sissoo		√			√	√		√
Delonix regia		√	√	√				
Emblica officinalis	√		√	√			√	√
Ficus benghalensis	√	√	√	√	√	√		
Ficus glomerata	√		√	√	√	√	√	√
Ficus religiosa	√	√	√	√	√	√	√	√
Gmelina arborea	√						√	√
Jatropha carcus		√			√	√		
Mangifera indica	√	√			√		√	
Moringa oleifera	√	√	√	√				
Nerium indicum				√				
Pongamia pinnata		√		√		√		
Saraca indica	√		√	√			√	
Shorea robusta	√			√				√
Tamarindus indica	√						√	√
Tectona grandis		√		√			√	
Terminalia arjuna		√				√		

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

Species	Home Stead	Road side	B/W Road	Institution	Near Pond	Drain line	Private Land	Others
Acacia nilotica		√	√					√
Aegle marmelos	√	√		√	√	√	√	
Albizia spp.	√							
Alstonia scholaris		√					√	
Annona squamosa	√				√			√
Azadirachta indica	√		√			√	√	√
Bixa orellana	√							
Cassia fistula				√				
Dalbergia sissoo		√		√	√			√
Delonix regia	√	√		√			√	
Gmelina arborea	√						√	
Hibiscus rosa sinensis	√				√			
Jatropha carcus		√	√			√		
Melia azedarach		√	√			√		√
Murraya koenigii	√							
Musa paradisiaca	√						√	
Nerium indicum		√	√	√			√	
Polyalthia longifolia		√						√

Psidium guajava	√			√	√			
Ricinus communis		√						
Syzygium cumini	√	√			√	√	√	
Ziziphus mauritiana	√	√		√	√			√

Diversity of macro-fungi in Central India-XXII: Diversity of *Laetiporus sulphureus* in TFRI campus

R.K. Verma, Vimal Pandro, Diwyansh Raj and A.J.K. Asaiya

Forest Pathology Division
Tropical Forest Research Institute
(Indian Council of Forestry Research & Education, Ministry of Environment, Forests and Climate Change, Govt. of India)
Jabalpur -482 021, Madhya Pradesh
E-mail: vermaramk@icfre.org

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 are 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* (Burdsall and Banik, 2001). *Laetiporus sulphureus* is an edible mushroom some other edible mushrooms recently reported from central India includes: *Astraeus hygrometricus, Auricularia auricular-judae, 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

campus of Tropical Forest Research Institute, Jabalpur.

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

S.N.	Host	Date of collection	Specimen No. (TF)	Locality	No. of culms/ plants observed	No. of affected plants	Damage (%)
1.	*Bambusa vulgaris* var. *yellow*	03/09/2018	4176	Agro-forestry nursery	15	13	86.7
2.	*Embelica officinalis*	03/09/2018	4175	Agro-forestry	5	01	20.0

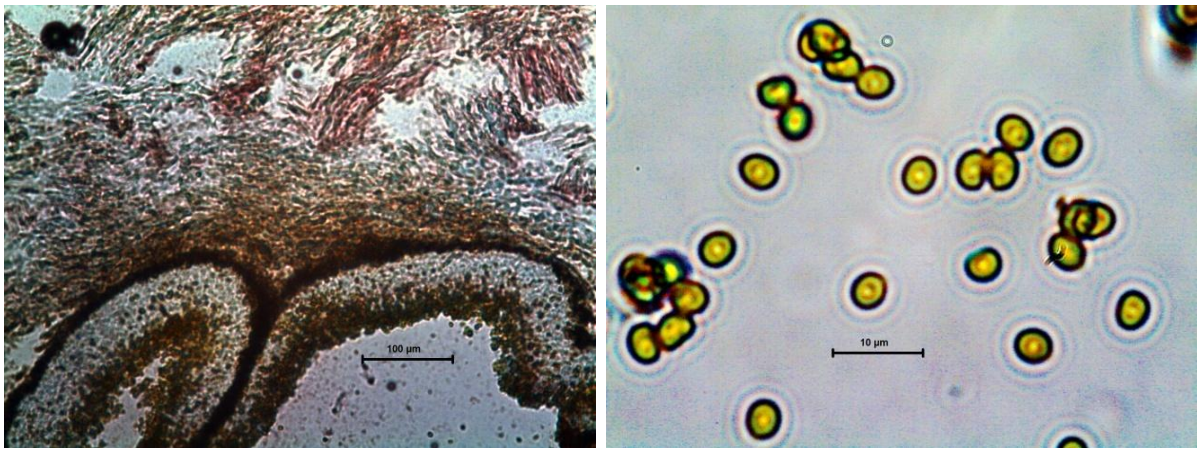
				nursery			
3.	*Butea monosperma*	03/09/2018	4177	Agro-forestry nursery	2	01	50.0
4.	*Dendrocala mus strictus*	05/09/2018	4187	Silviculture plantation area	81	12	14.8
5.	*Dendrocala mus strictus*	03/09/2018	4184	Beside Rest House	50	06	12.0

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

Figures 5-6 *Laetiporus sulphureus*: On *Dendrocalamus strictus*

Figures 7-8 *Laetiporus sulphureus*: On *Butea monosperma*



Figures 9-10. *Laetiporus sulphureus*, 5 cross section of pore layer, 6 hyphal system and basidiospores

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).

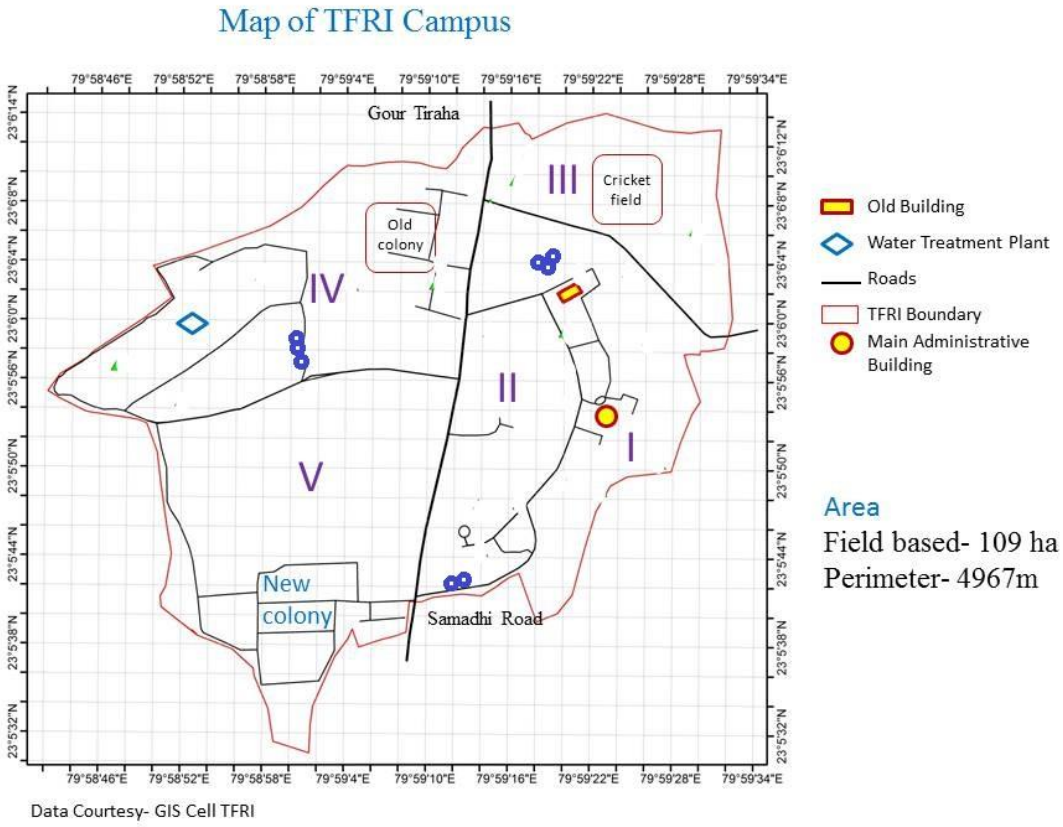


Figure 11: Distribution of *Laetiporus sulphureus* in TFRI campus, Jabalpur, Madhya Pradesh (shown with blue rounded dots)

Discussion

Laetiporus sulphureus is commonly grow on bamboos (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.

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

P. Shivakumar Singh[1] and G.M. Vidyasagar[2]

[1]Department of Botany, Palamuru University, Mahabubnagr-509001, Telangana State, India.
[2]Medicinal 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 identificDtion of di ٔerent 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

Sl. No	Scientific name	Common name	Eco-friendly-anti chemicals activity
1	*Aloe vera*	Aloe	Absorbs farmalidhe, benzene
2	*Chlorophytum comosum*	Spider plant	Absorbs Farmoldihide, Corbon monoxide, Glycine
3	*Syngonium podophyllum*	Wiping pig plant	Absorbs Farmoldihide, benzene, Trichloro-ethylyne
4	*Aglaonema spp*	Chinese evergreen plant	Reduces environment pollution
5	*Dracaena marginata*	Red edged plant	Absorbs Farmoldihide, Glycine, Trichloro-ethylyne
6	*Sansevieria spp*	Hard leaf plant	Absorbs Farmoldihide
7	Ficus *elastica*	Rubber plant	Absorbs Farmoldihide
8	*Sansevieria trifasciata*	Snake plant	Absorbs Farmoldihide, wash rooms soap, shampoos pollution reduces.
9	*Spathiphyllum wallisii*	Peace lilly	Absorbs Farmoldihide, benzene, Trichloro-ethylyne
10	*Pothos spp*	Pothus plant	Inactivates Farmoldihide
11	*Hedera helix*	English Ivey plant	Animal produced bacteria will be destroyed.
12	*Euphorbia tirucalli*	Kalli plant	Misquotes repellent
13	*Abilmascus easculentum*	Cucumber	Antimicrobial activity.

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, hytoextrac- uption 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 weapthe order of 10_12 mol/kg) compared with much higher effecconcentrations 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 pros-pect of phytoextraction of 137Cs from contaminated soil is minimized because sorption of Cs into interlayer spaces on mica–illite minerals appears to be highly spe-cific 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 (<10ppm). In contrast, metal hyper accumulator plants can accumulate exceptionally high amounts of metals (in the thousands of ppm). Hyper accumulator 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 presents 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 *rhizoliltration* 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. Afer 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 *bioavailibility* 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 then 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

CONCLUSSION

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.

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हानिकारक खरपतवारः प्रबंधन एवं नियंत्रण

ममता पुरोहित, योगेश पारधी एवं राजेश कुमार मिश्रा

उष्णकटिबंधीय वन अनुसंधान संस्थान
(भारतीय वानिकी अनुसंधान एवं शिक्षा परिषद, पर्यावरण, वन और जलवायु परिवर्तन मंत्रालय, भारत सरकार)
जबलपुर

खरपतवार ऐसे अवांछनीय पौधे या झाड़ियाँ है जो चारा, अनाज प्रजातियों एवं अन्य वानिकी प्रजातियों को भारी नुकसान पहुँचाने के साथ-साथ पालतू पशुओं और मानव समुदाय को भी प्रभावित करते हैं। खरपतवार प्रायः सभी स्थानों जैसे घर के आसपास, खेतों, जंगलों, सड़कों के किनारे, रेलमार्गों के किनारे, चारागहों, तालाबों, झीलों, नदियों आदि के आसपास आसानी से वृद्धि करते हुए देखे जाते हैं व इन स्थानों की उपयोगिता को प्रभावित करते हैं। खरपतवारों के आक्रमण से चारा, कृषि फसलों, साग-सब्जियों, फूलों, फलों एवं अन्य उपयोगी वानस्पतिक प्रजातियों के उत्पादन और गुणवत्ता पर विपरीत प्रभाव पड़ता है । खरपतवार न केवल पानी, प्रकाश और पोषक तत्वों के लिए प्रतिस्पर्धा करते हैं बल्कि ये वांछित उपज के उत्पादन को कम करते हैं, गुणवत्ता में कमी आ जाती है तथा चारे आदि का स्वाद बिगड़ जाता है । इतना ही नहीं कई खरपतवार कई कीटों एवं रोगजनित फफूँद प्रजातियों को आश्रय देते हैं एवं रोगों के फैलने में सहायता देकर आर्थिक नुकसान पहुँचाते हैं । वर्तमान समय में खरपतवारों के नियंत्रण के लिए ऐसी तकनीकों का उपयोग करने की आवश्यकता है जो पर्यावरण के अनुकूल हों । एकीकृत खरपतवार नियंत्रण के अंतर्गत ऐसी तकनीकें व्यवसायिक रूप से मानकीकृत की गईं हैं जिन्हें हानिकारक जीव नियंत्रण उपायों के साथ इस्तेमाल करने पर अधिक प्रभावी एवं किफायती पाया गया है। हमारे देश में पिछले कुछ दशकों से जनमानस को जागरुक करने के लिए कांग्रेस घांस या गाजर घांस (*पार्थेनियम हिस्टोरोफोरस*) के हानिकारक प्रभावों से बचने के लिए विज्ञान पत्र-पत्रिकाओं एवं दैनिक समाचार पत्रों में बार-बार छापा जा रहा है। सर्वप्रथम कर्नाटक सरकार ने मनुष्यों, पशुओं एवं कृषि फसलों में होनेवाले नुकसान को देखते हुए 23 अक्टूबर 1975 को एक अधिसूचना जारी कर गाजर घांस को हानिकारक खरपतवार के रूप में घोषित किया जो शीर्ष सात खरपतवारों में से एक है।

***Lantana camara* (टनटनी, फुल्लकरी, कुर्री)**

हानिकारक खरपतवार प्रजातियाँ

कुछ हानिकारक खरपतवार प्रजातियों के नाम निम्नानुसार हैं

Avena fatua (जंगल जई)

Calotropis procera (आक, मदार)

Carthamus oxyacantha (कंदियारी)

Cyperus rotundus (ग़नटोला)

Euphorbia hirta (बड़ी दूधी)

Euphorbia hypericifolia (दूधिया)

Lantana camara (टनटनी, फुल्लकरी, कुर्री)

Pluchea lanceolata (बेसुरी)
Saccharum spontanem (कांस)
Xanthium strumarium (बड़ा गोखरू)

Euphorbia hypericifolia **(दूधिया)**

खरपतवारों के हानिकारक प्रभाव

खरपतवार की विभिन्न हानिकारक प्रजातियाँ निम्नलिखित प्रकार से हानिकारक प्रभाव डालती हैं:

1. मृदा जल पर प्रभाव

खरपतवार अपनी वृद्धि के लिए अधिक भूजल अवशोषित करते हैं क्योंकि इनका जलोत्सर्जन गुणांक अन्य प्रजातियों की अपेक्षा कई गुना अधिक होता है । फलस्वरुप कृषि फसलों आदि की वृद्धि एवं उत्पादन के लिए आवश्यक जल की कमी हो जाती है जिससे उत्पादन कम होता है ।

2. पोषक तत्वों पर प्रभाव

खरपतवार उपयोगी पौध प्रजातियों के साथ पोषक तत्वों के लिए प्रतिस्पर्धा करते हैं । यह प्रतिस्पर्धा मृदा में पोषक तत्वों की कमी होने पर और अधिक बढ़ जाती है फलतः उपज की गुणवत्ता का ह्रास होता है ।

3. लाभकारी जीवाणुओं पर प्रभाव

मृदा में उपस्थित लाभकारी जीवाणुओं पर भी विपरीत प्रभाव पड़ता है । जिससे मृदा की उर्वरकता आदि में कमी आ जाती है ।

4. दलहनी एवं तिलहनी फसलों पर प्रभाव

इन फसलों में प्रोटीन एवं तेल का प्रतिशत कम हो जाता है ।

5. गन्ना फसल पर प्रभाव

इस फसल में शर्करा का प्रतिशत कम हो जाता है ।

6. साग-सब्जियों पर प्रभाव

साग-सब्जियों के स्वाद में कमी आ जाती है एवं अन्य पौष्टिक गुणों का ह्रास हो जाता है ।

7. हरा चारा पर प्रभाव

हरा चारा उत्पादन में कमी आ जाती है एवं हरे चारे का स्वाद बिगड़ जाता है ।

8. नत्रजन स्थिरीकरण पर प्रभाव

विभिन्न खरपतवार नाशी रसायनों के लगातार उपयोग से उन कृषि व वानिकी प्रजातियों में जिनकी जड़ों में पायी जानेवाली ग्रंथियों में नत्रजन स्थिरीकरण करने वाले बैक्टिरिया होते हैं, की जड़ ग्रंथियों की सँख्या एवं भार में कमी आ जाती है । फलतः नत्रजन स्थिरीकरण की प्रक्रिया प्रभावित होती है एवं नत्रजन की कमी से पैदावार कम हो जाती है ।

9. पैदावार पर प्रभाव

खरपतवारों के कारण फसलों के उत्पादन में 30 से 40 प्रतिशत की कमी आ जाती है तथा गुणवत्ता का ह्रास 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

खरपतवार युक्त खेतों में कृषि कार्यों के दौरान यंत्रों तथा मशीनों की कार्यक्षमता घट जाती है तथा टूट-फूट आदि होने से उनकी आयु भी घट जाती है ।

11. मानव समुदाय पर प्रभाव

खरपतवारों जैसे गाजर घांस आदि के कारण मनुष्य में त्वचा एवं श्वसन संबंधी गंभीर बीमारियाँ हो जाती हैं ।

12. पालतू पशुओं पर प्रभाव

खरपतवारों के कारण पालतू पशुओं से प्राप्त होनेवाले उत्पादों जैसे दूध, मांस, ऊन, खाल आदि पर बुरा प्रभाव पड़ता है। दूध में गंध आने लगती है, मांस की गुणवत्ता में कमी आ जाती है तथा कांटेदार खरपतवारों के कारण पालतू पशुओं एवं जानवरों की खाल तथा ऊन में खराबी आ जाती है।

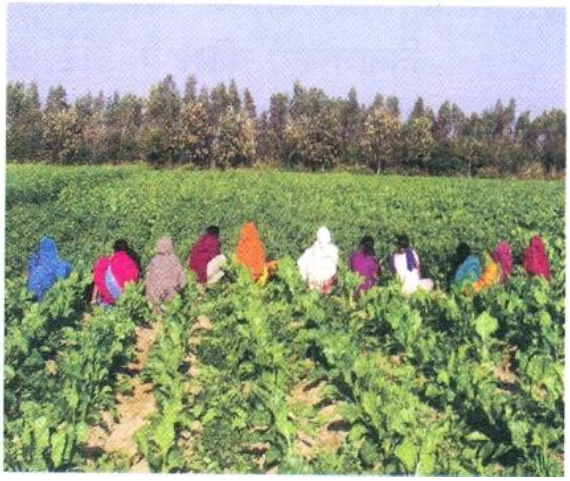
आश्रयदायी खरपतवार

आश्रयदाता के रूप में खरपतवार की विभिन्न प्रजातियाँ निम्नलिखित प्रकार से फसलों को हानि पहुँचाती हैं:

1. खरपतवार विभिन्न प्रकार की फसलों को नुकसान पहुँचानेवाले कीटों, फफूँदों तथा रोगकारक जीवाणूओं को आश्रय देते हैं विशेषकर उस समय जब खेतों में फसलों के पौधे नहीं होते हैं।
2. खेतों में फसलों के पौधे आ जाने पर ये कीटों, फफूँदों तथा रोगकारक जीवाणुओं द्वारा रोग फैलने में मदद कर आर्थिक नुकसान पहुँचाते हैं।

समन्वित खरपतवार प्रबंधन एवं नियंत्रण

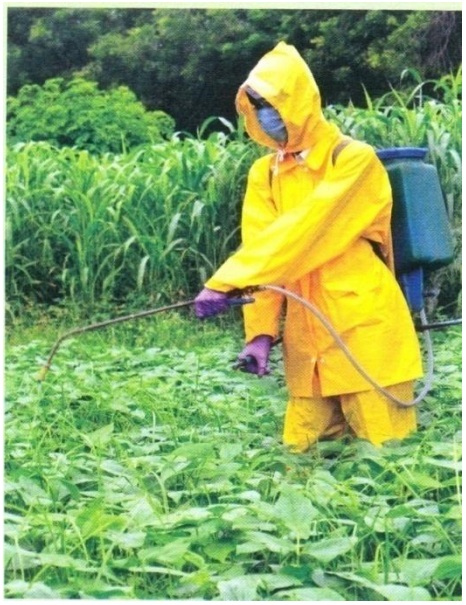
खरपतवारों की प्रभावी रोकथाम या नियंत्रंण तभी भली प्रकार से किया जा सकता है जब उनके प्रसार की विस्तृत जानकारी हो जैसे भिन्न-भिन्न खरपतवारों का जीवन चक्र, सुषुप्तावस्था, प्रतिकूल परिस्थितियों के प्रति प्रतिरोधक क्षमता आदि । खरपतवारों को नष्ट करने के लिये आवश्यक उपायों को निम्नानुसार दो विधियों में वर्गीकृत कर सकते हैं:



हांथ द्वारा खरपतवार नियंत्रण

प्रतिबंधात्मक विधियाँ

1. खरपतवार रहित बीजों का उत्पादन करना।
2. खरपतवार रहित शुद्ध बीज बोना।
3. प्रक्षेत्र का उत्तम प्रबंधन।
4. कृषि में उपयोग आनेवाले यंत्रों एवं मशीनों की समय-समय पर साफ-सफाई एवं मरम्मत करना।
5. प्रक्षेत्र में अच्छी प्रकार की सड़ी-गली गोबर खाद व अन्य कार्बनिक खादों का प्रयोग करना।
6. सिंचाई की नालियों व नहरों के किनारे ऊगे हुए खरपतवारों को नष्ट करना।
7. खेत एवं खेत 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 गुजरने देना जहाँ पर खरपतवार ऊग रहे हों।



शाकनाशक का छिड़काव

नियंत्रण विधियाँ

1. यंत्रों एवं मशीनों द्वारा

खरपतवारों की प्रजाति एवं सघनता के आधार पर यंत्रों व मशीनों की सहायता से खरपतवार नियंत्रण किया जा सकता है।

2. हाथों द्वारा

घर के बगीचों, आंगनबाड़ी, रोपणी आदि में ऊगी हुई खरपतवारों को हाथ से चुनकर निकाला जा सकता है।

3. निंदाई-गुड़ाई

इसमें खरपतवारों को नष्ट करने के लिए खुरपी, फावड़ा, गैंती 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 भंडार समाप्त हो जाता है और खरपतवार नष्ट हो जाते हैं।

5. कृत्रिम आवरण (मल्चिंग का प्रयोग) द्वारा

खरपतवारों का कृत्रिम आवरण के द्वारा वायु 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 मग्नता द्वारा

इस विधी में खरपतवारों को जलमग्न रखते हैं जिससे श्वसन क्रिया सुचारू रूप से न होने के कारण वे नष्ट हो जाते हैं।

7. आग द्वारा

बहुवर्षीय खरपतवारों को अधिकतर आग लगाकर नष्ट किया जाता है।

8. शस्य विधी द्वारा

फसल चक्र में परिवर्तन कर तथा फसलों को विभिन्न प्रकार से उगाकर खरपतवारों को नष्ट करने की विधी को शस्य विधी कहते हैं। इस विधी में खरपतवारों का नियंत्रण फसल चक्रों का उपयोग, बीज बोने का समय, बीज की मात्रा, कतारों से कतारों की दूरी तथा कतार में पौधों की दूरी एवं फसलों के चयन आदि द्वारा किया जाता है।

9. शाक नाशियों द्वारा

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

एकीकृत खरपतवार प्रबंधन एवं नियंत्रण

एकीकृत खरपतवार प्रबंधन कीट प्रबंधन का एक महत्वपूर्ण घटक है तथा पर्यावरण, मानव स्वास्थ्य एवं लाभकारी जीवों को ध्यान में रखकर किया जाता है जिससे इन पर हानिकारक प्रभाव न पड़े एवं दीर्घकालिक समाधान प्राप्त हो सके। एकीकृत खरपतवार प्रबंधन विभिन्न तकनीकियों जैसे जैविक नियंत्रण, प्राकृतिक वास परिवर्तन, कृषि प्रणाली में सुधार, प्रतिरोधी किस्मों का प्रयोग आदि के समायोजन पर केन्द्रित है तथा खरपतवारों को नियंत्रित करने के लिए

रासायनिक शाकनाशकों पर निर्भरता को कम करता है।

खरपतवार प्रबंधन एवं नियंत्रण के लिए आवश्यक है कि एक ही नियंत्रण विधी को न अपनाकर एकीकृत समन्वित खरपतवार नियंत्रण एवं प्रबंधन प्रणाली का उपयोग करना चाहिए जिससे फसल प्रजातियों एवं मृदा पर हानिकारक प्रभाव न पड़े। यदि उपर्युक्त बातों को ध्यान में रखा जाये तो नये प्रक्षेत्रों में खरपतवारों का प्रसार या संक्रमण रोका जा सकता है।

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P.O. RFRC, Mandla Road
Jabalpur – 482021, M.P. India
Phone: 91-761-2840484
Fax: 91-761-2840484
E-mail: vansangyan_tfri@icfre.org, vansangyan@gmail.com
Visit us at: http://tfri.icfre.org or http://tfri.icfre.org