(ISSN 2395 - 468X)
Year - 2020 Vol. 7, No. 5 Issue: May 2020

Van Sangyan

A monthly open access e-magazine

Indexed in:

COSMOS Foundation (Germany)

International Inst. of Org. Res. (Australia)

Tropical Forest Research Institute
(Indian Council of Forestry Research and Education)
Ministry of Environment, Forests and Climate Change (MoEFCC)
PO RFRC, Mandla Road, Jabalpur – 482021, India

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

Bamboo is one of the fastest growing plants which have ability to survive in a wide variety of climatic and edaphic conditions. It generally forms the under-storey in the natural forests. There are 124 indigenous and exotics species, under 23 genera, found naturally and/or under cultivation. The bamboos occur as either an under storey or in pure form in all other parts, except the Kashmir Valley. The bamboos are widely distributed in India. It is found to grow practically all over the country, particularly in the tropical, sub-tropical and temperate regions where the annual rainfall ranges between 1,200 to 4,000 mm and the temperature varies between 16 and 38 C. The most suitable conditions for occurrence of bamboo are found in between 770-1,080 m amsl. It can be also grown on marginal and degraded lands, elevated grounds, along field bunds and river banks. Two-thirds of the growing stock of bamboos in the country is available in the North-Eastern states. They abundantly occur in Andhra Pradesh, Arunachal Pradesh, Assam, Manipur, Meghalaya, Mizoram,Nagaland, Sikkim, Tripura, Orissa, West Bengal and Madhya Pradesh states. A few species are also found scattered in other parts of the country both in the hills and the plains.

Bamboo is one of the most primitive plant species that survive today as "The Green Gold" of the 21th. century. The bamboo is extraordinary and unique plant of our planet because it is the fastest growing plant and is annually renewable and harvestable if managed intensively . Bamboo is productive, sustainable and versatile plant and one of the important Non-Wood Forest Products (NWFP), providing food, raw material and shelter and found in wide variety of climatic and edaphic conditions.Agroforestry is a dynamic, ecologically based natural resources management system that,through the integration of trees in farms and in the agriculture landscape, diversifies and sustains production for increased social, economic, and environmental benefits for land users at all levels. Bamboo based agroforestry can play an important role in enhancing sustainability and resource conservation. Bamboos have many advantages over tree such as, relatively short time span from planting to harvest, can grow 3 times faster than Eucalyptus & release 35% more O2 than equivalent strands of other tree. Bamboos require four to five years to yield first harvest. Bamboo grows in different types of soils ranging from rich alluvium to hard lateritic soils and coastal sandy saline soils. The farming community will do well to take up bamboo planting as there is scope for regular income from well managed plantations besides providing for a multitude of other small produce like leaf for fodder, poles for agricultural use, thorns for fencing and dead rhizomes for fuel.

In line with the above this issue of Van Sangyan contains an article on Bamboo based multipurpose windbreak – An effective measure for reduction of wind disaster in Tripura. There also useful articles viz.. Anamirta cocculus: An important medicinal plant, प्रदूषण सहिष्णु पौधों के साथ बढ़ाएं हरियाली, Amarbel, Cuscuta reflexa Roxb. – An invasive alien species and Contribution of GDP through NTFP and their marketing channels.

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. Pawan Rana
Scientist 'E' & Chief Editor

© Published by Tropical Forest Research Institute, Jabalpur, MP, India

Disclaimer – Van Sangyan

Statement of Responsibility

Neither *Van Sangyan* (VS) nor its editors, publishers, owners or anyone else involved in creating, producing or delivering *Van Sangyan* (VS) or the materials contained therein, assumes any liability or responsibility for the accuracy, completeness, or usefulness of any information provided in *Van Sangyan* (VS), nor shall they be liable for any direct, indirect, incidental, special, consequential or punitive damages arising out of the use of *Van Sangyan* (VS) or its contents. While the advice and information in this e-magazine are believed to be true and accurate on the date of its publication, neither the editors, publisher, owners nor the authors can accept any legal responsibility for any errors or omissions that may be made or for the results obtained from the use of such material. The editors, publisher or owners, make no warranty, express or implied, with respect to the material contained herein.

Opinions, discussions, views and recommendations are solely those of the authors and not of *Van Sangyan* (VS) or its publishers. *Van Sangyan* and its editors, publishers or owners make no representations or warranties with respect to the information offered or provided within or through the *Van Sangyan. Van Sangyan* and its publishers will not be liable for any direct, indirect, consequential, special, exemplary, or other damages arising there from.

Van Sangyan (VS) reserves the right, at its sole discretion, to change the terms and conditions from time to time and your access of *Van Sangyan* (VS) or its website will be deemed to be your acceptance of an agreement to any changed terms and conditions.

Contents **Page**

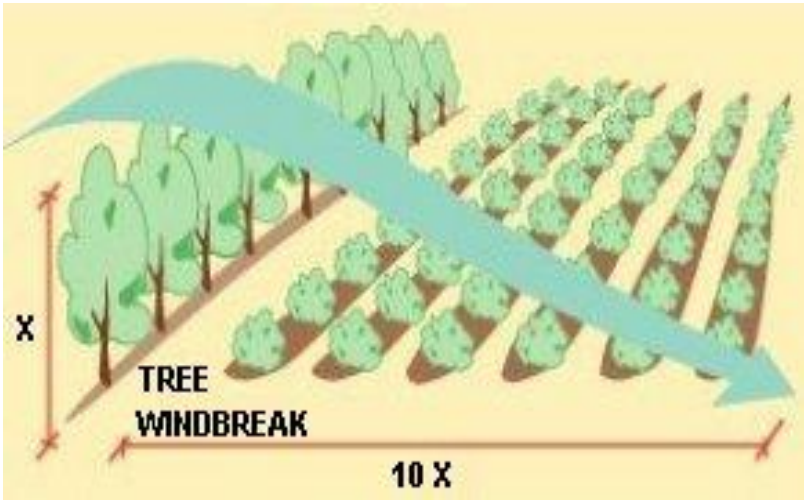
Bamboo based multipurpose windbreak – An effective measure for reduction of wind disaster in Tripura

Pawan K Kaushik, Prasenjit Choudhury and Nabarun Paul

Forest Research Centre for Livelihood Extension
(Indian Council of Forestry Research & Education, Ministry of Environment, Forests and Climate Change, Govt. of India)
Agartala

Introduction

Windbreak**,** the name suggests that it is mainly used to break the wind-flow and reduce wind speed.Windbreaks are barriers planted on borders of farm plots that help to slow down the speed of winds. Usually consisting of trees and shrubs, they also may integrate perennial or annual crops, tall grasses, wooden fences, or other materials. The mainly purpose is to provide a protected environment to save the crops from damage by strong winds and thus helpsin obtaining higher yields, controlling erosion, creating habitat for wildlife,yielding tree products besides improving the landscape aesthetics.



An ideal windbreak is composed of several rows of trees planted at spacing that will give a particular reduction in wind speed, without eddying or turbulence that would be caused by an impenetrable screen.

According to their uses, Windbreaks can be divided as:

Farmstead Windbreaks

These windbreaks are used for protecting the buildings, cattle shelters, greenhouses etc. from strong winds.

Field Windbreaks

Functions of these windbreaks are to regulate soil erosion and protect the crop against turbulent winds.

Living Snow Fences

These windbreaks are established for trapping the snow before it drifts onto lane ways or farmyards.

The first two windbreaks are suitable and applicable in case of wind disasters in Tripura

In Tripura, cyclone has been a havoc which had caused huge economic embarrassment due to loss of life, crops and properties.The storms,in the year 2012, damaged about 5,000 houses and uprooted several electric posts and trees. In case of crops, a perennial crop like Rubber suffers a lot due to cyclone that usually takes place during the month from April to July in almost every year. Rubber growers reportedly faced huge hardship due to

cyclone in the state. In April 2014, a total of 1450 houses were damaged and a large population was displaced from their homes due to the cyclone in North Tripura and other parts of Tripura.In June 2015, about 200 families were displaced from their houses in Ambassa sub-division of Dhalai district and many trees and electric posts were uprooted due to the storm over night. A total of 250 houses were totally damaged and more than 1000 houses partly damaged due to the cyclone and hailstorm over nightat Lakkhipur village under Jirania subdivision of West Tripura district, in March 2016.200 families were evicted from their houses from two villages — Shabdakarpara and Bongshipara and they took shelter in government buildings near Jirania.

Windbreak obstructs the wind flow and alters flow patterns both upwind of the barrier (windward zone) and downwind of the barrier (leeward zone). As wind approaches a windbreak, some of the air passes through the barrier while the rest flows around the ends of the barrier or is forced up and over the barrier. Due to the pressure fields wind speed is reduced and a protected zone is created which extends for a distance of 2H to 5H in the windward zone and 10H to 30H in the leeward zone (where H is the height of the barrier).

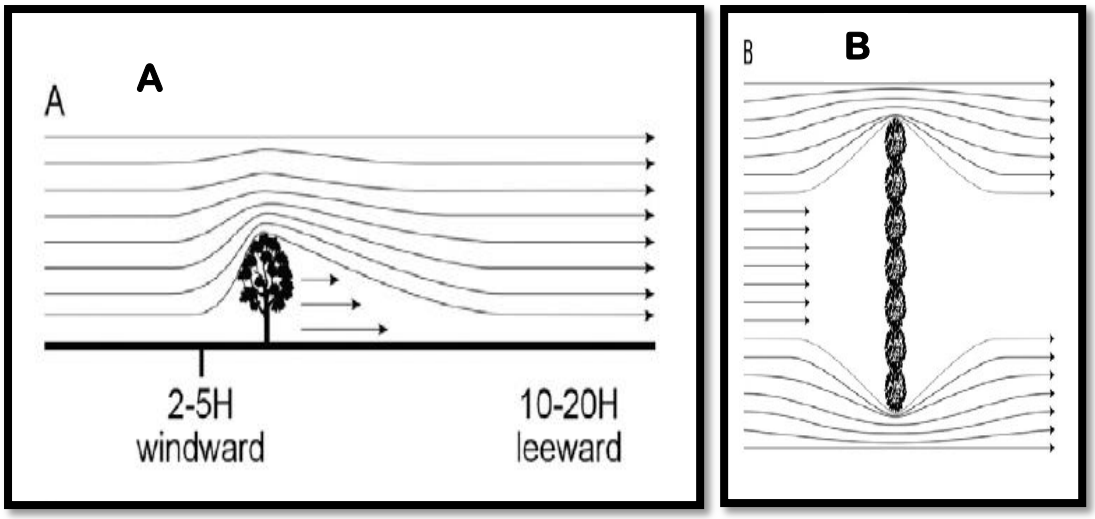


Fig . 1A: Showing the wind path side wards of a wind break. **B:** Showing the wind path from upwards a windbreak.

Points to remember before setting a windbreak

- Windbreak height (H) is the most important factor determining the extent of the area to be protected.
- Windbreaks should be perpendicular to the wind.
- The length of a windbreak should be at least ten times its height to minimize the effect of wind flow around the ends of the windbreak.
- Increased flow around the ends or through a gap directly reduces the extent of the protected zone and reduces windbreak effectiveness. So windbreak continuity is also very important.

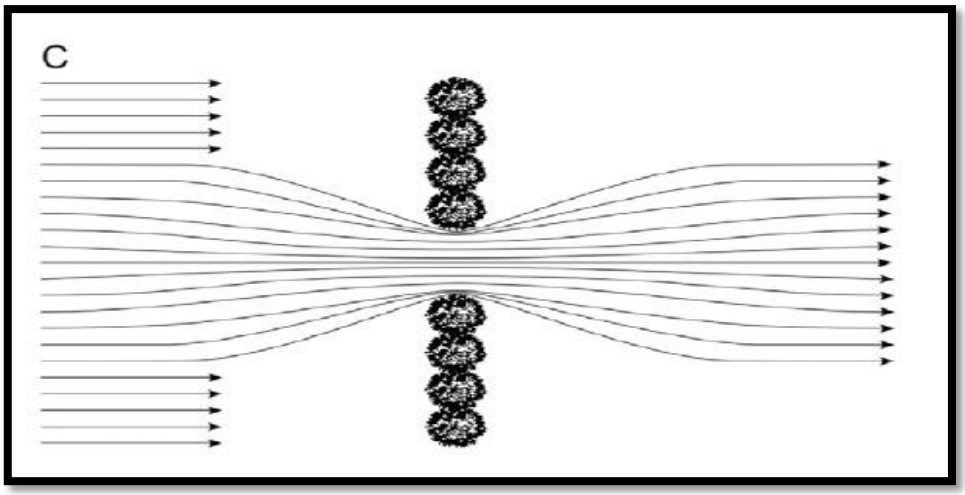


Fig. 2:- Showing the wind flow through a hole in the windbreak.

Benefits of windbreaks

1. Reduction in soil erosion form wind.
2. Protects plants from wind related damages.
3. Alter microenvironment for enhancing plant growth.
4. Improves irrigation efficiency.
5. Provides shelter for structures, livestock and recreational areas.
6. Enhance wildlife habitat by providing travel corridors.

To attain the above mentioned benefits theorientation (location & layout) of thewindbreak should be perpendicular to troublesome winds and also it should connect fragmented habitat of targeted species in case of enhancing wildlife habitat, species-mix of deciduous & conifer, height-match heights of vegetation in potential plant community , density-60-80 %, width-normally 3-5 rows but can exceed,management-maintain density through pruning , thinning, or planting, operation and maintenance-replace dead stock in first 3-5 years and control damaging agents,limitations- Limited protection initially.

Why bamboo is most suitable for windbreak in Tripura

In view of the characteristics of Bamboo species available in Tripura and also the literature available at "bamboo-Inspiration" website, bamboos shall be potential component in terms of the followings -

Flexibility

It is a much flexible plant and will bend and sway in the strongest wind speeds with only the very youngest culms suffering

damage. They are likely to bend within the wind as against blowing over. Bamboos have the power to bend to ground level under the load of snow, ice, or heavy rains, and high winds, then straighten copy to their full height once the conditions have eased.

Root Mass

A mature grove features a root mass that maintains anchorage within the ground in extreme weather. This means, it is unlikely to cause damage or a danger to people as it does not get uprooted in the same way as individual trees in gales, hurricanes, and tornados.

Stability

The steadiness of a bamboo windbreak or grove reportedly offers protection to people and property in extreme weather, the high speed winds, and even in earthquakes. The bamboo groves offer protection in the event of an earthquake due to the huge root mass which stabilizes the earth which results with a low risk of danger through culms falling and causing injury.

Multipurpose use of bamboo

- Bamboo is used locally for handicrafts, culmsod few species are also used inbamboo-wood industry of the state. It can be planted for land rehabilitation of degraded lands and riverbank stabilisation etc.
- Bamboo also used locally for manufacturing of bamboo furniture, chopsticks etc.
- Bamboo after treatment, used for building bamboo houses and also for manufacturing of high quality furniture from bamboo-wood.
- It is also used for making kitchen utensils.
- Some varieties are often used for landscaping.
- In rural areas bamboo is reliable and cheap source of house construction.
- More over the handicraft industry can provide a good income source for livelihood in these days.

Fig. 3:- Manufacturing of bamboo based handicrafts in villages.

Suitable species for establishment of windbreak in Tripura and other North Eastern States are-

1st row (Windward side)

Bambusapolymorpha, Melocannabeccifera, Bambusabalcooa, Bambusatulda, Agavasisalana, Tactonagrandis, Dipterocarpus so., Calotropisprocera, Euphorbia sp., Lawsoniaalba, Tephrosia candida etc.

2nd row (Middle)

Acacia sp., Bombexceiba, Dalbergiasissoo, Shorearobusta, Anacardiumoccidentale, Toonaciliata, Eucalyptus sp., Cocosnucifera, Terminaliaarjuna, Artocarpusintegrifoia, Eugenia sp., Azadirachtaindica, Tectonagrandis etc.Thysanolaena maxima and *Schumanianthusdichotoma* intercropping.

3rd row (Leeward side)

Bambusa spp., Artocarpus sp., Azadirachta indica, Eugenia sp., Mangifera indica, Zyzyphussp, Shorea robusta etc.

Tripura is the second largest producer of Rubber. Rubber plantations are very badly affected during the rainy season, due to high wind speed. Large numbers of rubber plants are uprooted. Bamboo based Windbreaks shall be much effective in protection of rubber plantations from Norwesters in Tripura and thus the huge loss can be minimized.

In coming days, it is expected that a large number of upcoming infrastructures, houses and cropsmay be under especially in the hilly areas in Tripura due to high wind speed. The bamboo based multipurpose windbreaks may be much effective in reduction of such wind disaster.

Anamirta cocculus: An important medicinal plant

Gutti Pavan and Deepa M

Forest ecology and Climate change
Institute of Forest Biodiversity
(Indian Council of Forestry Research & Education, Ministry of Environment, Forests and Climate Change, Govt. of India)
Dullapally, Hyderabad, Telangana (India)-500100

Introduction

Anamirta cocculus is a Southeast Asian and Indian climbing plant. Its fruit is the source of picrotoxin, a poisonous compound with stimulant properties. The plant is large-stemmed (up to 10 cm in diameter); the bark is "corky gray" with white wood. The "small, yellowish-white, sweet-scented" flowers vary between 6 and 10 millimeters across; the fruit produced is a drupe, "about 1 cm in diameter when dry. Chemical substances the stem and the roots contain quaternary alkaloids, such as berberine, palmatine, magnoflorine and columbamine. The seeds deliver picrotoxin, a sesquiterpene, while the seed shells contain the tertiary alkaloids menispermine and paramenispermine.

On a biochemical level, picrotoxin (or more precisely its active constituent, picrotoxinin) act as GABA (gamma-amino butyric acid) antagonists. It stimulates the central nervous system, particularly the medulla oblongata and respiratory center. Administration of picrotoxin via the vertebral artery decreased sinus rate and increased circulating levels of vasopressin. On the other hand, infusion of picrotoxin into the internal carotid artery caused increases in sinus rate, blood pressure and plasma vasopressin. These data support the hypothesis that GABAergic mechanisms at different levels of the neuraxis exert opposite effects on cardiac vagal activity, and that GABAergic mechanisms in both the brainstem and forebrain inhibit the release of vasopressins into the systemic circulation.

At receptor level, the GABA receptor is a complex, membrane-bound glycoprotein, operating a chloride-ion channel. When the endogenous agonist GABA is released into the synaptic cleft, the receptor opens its ion channel, resulting in an influx of chloride ions and hyperpolarization of the membrane, thus being responsible for the resulting pharmacological effects. On the GABA receptor site, barbiturates bind close to the chloride channel and, at least in part, increase chloride-ion conductance mimicking GABA activation. On the other hand, picrotoxinin specifically binds to the same barbiturate site, but blocks the opening of the chloride channel. Therefore, picrotoxin can be used as a specific barbiturate poisoning antagonist, although its safety limits are very narrow.

Furthermore, the fruits contain the isoquinoline alkaloids menispermine, paramenispermine, magnoflorine, stephorine, berberine, palmatine and l,8-oxotetrahydropalmatine. In addition, the stem and roots contain only small amounts (about 0.1%) of the alkaloids berberine, palmatine, magnoflorine, columbamine and l,8-oxotetrahydropalmatine. The stem also contains oxypalmine and stepharine. In general, the alkaloids isolated from *A. cocculus* have antibacterial-, antimicrobial-, sympatholytical-(acetylcholine), and antifertility activities.

Geographical Distribution

The Different Indian medicinal properties of plant species have made an outstanding contribution to the origin and evolution of many traditional herbal therapies. These traditional knowledge systems have started to recede from view with the passage of time due to the scarcity of written documents and relatively low income in these traditions. Over the past ten years, however, the medicinal plants have regained a wide recognition due to an increase rapidly faith in herbal medicine in view of its lesser side effects compared to allopathic medicine, in addition, the need of meeting the requirements of medicine for an increasing human population natural products of medicinal plants encompass a various chemical space for drug discovery filed.

India is rich with a flora of indigenous medicinal and herbs plants that have been utilized for centuries in traditional Indian medicine to treat human diseases treatment. India is well known for its harmony of traditional medicine and ethnopharmacology. It is noteworthy that traditional Indian medicinal formulations are different multi-component mixtures whose therapeutic use is based on empirical knowledge rather than a mechanistic understanding of the active ingredients in the mixture. Still recently, knowledge of traditional Indian medicine including important various medicinal plants and their formulations were buried within books such as Indian Materia Medica and Ayurveda Materia Medica. The nondigital nature of this information limited their effective use towards new drug discovery A perfect online database on the phytochemistry of Indian different medicinal plants will enable computational approaches towards natural product-based drug discovery. In this direction, IMPACT, a manually curated database of 1742 Indian Medicinal Plants, 9586 Phytochemicals, And 1824 Therapeutic uses spanning 27074 plant-phytochemical associations and 11514 plant-therapeutic associations. gallantly, the curation effort led to a non-redundant in the silicon library of 9496 phytochemicals with standard chemical identifiers and structure information. Using cheminformatic approaches, then they computed the physicochemical, ADMET (absorption, distribution, metabolism, excretion, toxicity) and drug-likeliness properties of the IMPACT photo chemical.

Use and diversity in medicinal plants

In India, of the 17,000 species of higher plants, 7500 are known for medicinal uses. This proportion of medicinal plants is the highest proportion of plants known for

their medical purposes in any country of the world for the existing flora of that respective country Ayurveda, the oldest medical system in Indian sub-continent, has alone reported approximately 2000 medicinal plant species, followed by Siddha and Unani The Charka Samhita, an age-old written document on herbal therapy, reports on the production of 340 herbal drugs and their indigenous uses. Currently, approximately 25% of drugs are derived from plants, and many others are synthetic analogues built on prototype compounds isolated from plant species in modern pharmacopoeia.

Anamirta Cocculus is a wild woody climber belonging to the family Menispermaceae, distributed throughout India similarly s South-East Asia. This seeds are known as Indian fish berry or crow killer and are being exploited by humans for hunting and fishing. The seeds are also used in eradicating the unwanted wild fishes from aquaculture ponds. Its fruits have been reported to posses wound heal-ing and anti-inflammatory activities.

Botany

Lagtang is a large woody vine with a corky, gray bark and white wood. Stems are sometimes 10 centimeters thick, longitudinally wadded, porous, with stout, smooth branches. Leaves are ovate or ovately-cordate, 10 to 20 centimeters long, with pointed or tapering apex and rounded or nearly heart-shaped base, smooth above, hairy on the nerve axils beneath, and 3-nerved from the base. Petioles are 5 to 15 centimeters long. Flowers are yellowish, sweet-scented, 6 to 7 millimeters across, crowded on 3- to 4.5 centimeters long, pendulous panicles. Fruit is a drupe, nearly spherical, about 1 centimeter in diameter when dry, smooth and hard.

Berberine

Plants are widely used as a major source of medicines for the treatment of different health disorders. There are a total of some 350,000 species of higher plants in the whole world, much less than the species of animals (6-10 million). Plants with medicinal properties, the gift of Mother Nature to mankind, are in use for centuries in the traditional systems of Siddha, Ayurveda, and Unani, etc. However, plants contribute to our lives more than animals mainly due to their extraordinary array of diverse classes of biochemical with a different of biological activities; the plant kingdom has been very useful for them to the health needs of man when no concept of surgical management existed. Even today almost 35 % of all prescribed medicines in the developed world contain ingredients derived from various medicinal plants; nowadays bioactive compounds isolated from various plants relieve much importance for the discovery of safe drugs and many ways.

Berberine is an alkaloid found in a wide variety of traditional plants, including goldthread, Oregon grape, goldenseal, barberry, tree turmeric, and Phellodendron. Within these plants, the berberine alkaloid can be found in the stem, bark, roots, and rhizomes of the plants. Berberine has a broad spectrum of pharmacological activities. Berberine comes to us from India and China and, where it was first used in traditional Chinese medicine and Ayurvedic medicine. Berberine compound is supplemented for its anti-diabetic and anti-inflammatory effects. It can also improve lower cholesterol intestinal health and. Berberine is lead to reduce glucose production in the liver. Human and animal research demonstrates that 1500mg of berberine, taken in three doses of 500mg each, of which equally effective as taking

5mg glibenclamide or 1000 mg of metformin, this two pharmaceuticals for treating to type II diabetes. Of which Effectiveness was measured by how well the drugs reduced biomarkers of type II diabetes.

Recent research has thrown light on the hypolipidemic activities and antidiabetic of the alkaloids. Berberine has been tested clinically in the various treatments of diarrhoea, oriental sore, trachoma diabetes mellitus type-2, hypercholesterolemia, and congestive cardiac failure disorder.

Recent research has thrown light on the hypolipidemic activities and antidiabetic of the alkaloids. Berberine has been tested clinically in the various treatments of diarrhoea, oriental sore, trachoma diabetes mellitus type-2, hypercholesterolemia, and congestive cardiac failure disorder.

Berberine has essential pharmacological things In addition to ant amoebic, anthelminthic, leishmanicidal and tuberculostatic shows activities, the inhibition effects on the development microbe's enterotoxin, the inhibition effects on duodenal fluid accumulation and ion fount, the inhibition effects on the muscle sheepishness, the inhibition of platelet aggregation, the stimulation of bile and bilirubin fount. The Compound also stopped ischemia-induced ventricular tachyarrhythmia, stimulated cardiac contractility, and let fall down peripheral vascular resistance and blood pressure via the suppression of delayed after-depolarization in the ventricular muscle in rats. It was also put forward upon an animal study that may have a hypotensive effect attributable to its acetylcholine potentiating properties in rats. the additional health efficient effects earmark for to contain immune stimulation via increased blood flow to the spleen, macrophage activation, elevation of platelet counts in cases of primary and secondary thrombocytopenia, and increased excretion of conjugated bilirubin in investigational hyperbilirubinemia. in addition, may possess antitumor assisting characteristics as specified by inhibition of the enzyme cyclooxygenase-2 (COX-2) transcription and N-acetyltransferase activity in colon and bladder cancer cell lines. Clinical studies with isolated berberine have shown significant success in the treatment of acute diarrhea, irritable bowel syndrome, type 2 diabetes, high BP, elevated blood lipids, Alzheimer's disease, and different cancers. Here's excessive about how berberine can assist in these conditions.

References

Ale Zehra, S. B. (2017, 07 23). In Vitro Evaluation of Antimicrobial Effect of Extracts of Medicinal Plant Leaves ;. *Journal of Medical Microbiology & Diagnosis*, 773-778. Retrieved from https://www.omicsonline.org/open-access/in-vitro-evaluation-of-antimicrobial-effect-of-extracts-of-medicinal-plantsleaves-2161-0703-1000236.php?aid=77869

Badakhshan Mahdi-Pour, S. L. (2012, 12). Antioxidant activity of methanol extracts of different parts of Lantana camara. *asian pacific journal of tropical biomedicine*, *2*(12), 960-965.

Chandra Prakash Kala, P. P. (2006, 8). Developing the medicinal plants sector in northern India: challenges and opportunities. *Journal of Ethnobiology and Ethnomedicine* , *32*, 1-15. doi: doi: 10.1186/

Fernando, C. D. (2015, may 25). Optimized enzymatic colorimetric

assay for determination of hydrogen peroxide (H2O2) scavenging activity of plant extracts. *MethodsX*, 1-9. doi:10.1016/j.mex.2015.05.001.

KalaisezhiyenPavithra. (2015, 03). Evaluation of free radical scavenging activity of various extracts of leaves from Kedrostis foetidissima (Jacq.) Cogn. *Food Science and Human Wellness, 04*(1), 42-46. doi:https://doi.org/10.1016/j.fshw.2015.02.001

Mohamed Senouci Bereksi*, H. H. (2015, 2 9). Evaluation of Antibacterial Activity of some Medicinal Plants Extracts Commonly Used in Algerian Traditional Medicine against some Pathogenic Bacteria. *A Multifaceted Journal in the field of Natural Products and Pharmacognosy, 10*(3), 507-512. doi:10.1155/2015/265425

Mohanraj K, K. B.-A. (2018, March). IMPPAT: A curated database of Indian Medicinal Plants, Phytochemistry And Therapeutics. *Scientific Reports*, 4329-4336. doi:March 2018Scientific Reports 8(4329)

Negulescu, A. M. (2011, 10 11). Methods for Total Antioxidant Activity Determination: A Review. *Biochemistry & Analytical Biochemistry, 1*(1), 1-10. doi:10.4172/2161-1009.1000106

Obeidat, M. (2012). Antimicrobial Activity of Crude Extracts of Some Plant Leaves. *Research Journal of, 7*(1), 59-67. doi: 10.3923/jm.2012.59.67

PN Timbadiya, M. M. (2018). Phytochemical screening, Antioxidant, Anti-inflammatory and Anti microbial activities of Aegle marmelos leaf extracts. *International Journal of Chemical Studies, 06*(02), 3509-3517. doi:http://dx.doi.org/10.20510/ukjpb/6/i3/173548

Senguttuvan, J. (2014, 5). Phytochemical analysis and evaluation of leaf and root parts of the medicinal herb, Hypochaeris radicata L. for in vitro antioxidant activities. *asian pacific journal*

Sharma Satish Kumar*, S. S. (2013, 03 6). Evaluation of Analgesic and Anti-Inflammatory activity of Abutilon indicum. *international journal of drug development and research, 5*(1), 402-407. Retrieved from https://www.researchgate.net/publication/263660432_Evaluation_of_Analgesic_and_Anti-Inflammatory_activity_of_Abutilon_indicum

Suresh V Nampoothiria, b. T. (2017, JUNE). Isolation and HPLC Quantification of Berberine Alkaloid from Alpinia galanga and Alpinia calcarata. *International Journal of Pharma Sciences and Research (IJPSR), 8*(6), 97-104. Retrieved from file:///C:/Users/Pavan/Downloads/IJPSR17-08-06-011%20(4).pdf

Tahir, K. M. (2016, 10 24). Evaluation of phytochemicals, antioxidant activity and amelioration of pulmonary fibrosis with Phyllanthus emblicaleaves. *BMC Complementary and Alternative Medicine*, 2-12. doi:0.1186/s12906-016-1387-3

Umer Qadir*, M. M. (2014, june 7). in vitro inhibition of selected human

fungal pathogens with various seed extracts of Anamirta cocculus (Linn.). *JOURNAL OF PHARMACY RESEARCH, 7*, 760-764.

Vijay D Tambe, a. R. (2014, 04 09). Estimation of Total Phenol, Tannin, Alkaloid and Flavonoid in Hibiscus Tiliaceus Linn. Wood Extracts. *Journal of Pharmacognosy and Phytochemistry, 2*(4), 41-47.

Wang K, F. X. (2017). The metabolism of berberine and its contribution to the pharmacological effects. *journal Drug Metabolism, 49*(2), 139-157 . doi:doi.org/10.1080/03602532.2017.1306544

प्रदूषण सहिष्णु पौधों के साथ बढ़ाएं हरियाली

Anamika Asati[1], Pradeep Kori and M. Rajkumar[2]

[1]Department of Life sciences
Devi Ahilya Vishwavidyala, Khandwa Road, Indore 452017
[2]Forest Ecology and Climate Change Division
Tropical Forest Research Institute
(Indian Council of Forestry Research & Education, Ministry of Environment, Forests and Climate Change, Govt. of India)
P.O. RFRC, Mandla Road, Jabalpur 482021

वायु प्रदूषण प्रगतिशील शहरो में एक बड़ी गंभीर समस्या बनता जा रहा है। इस प्रदूषण के कारण शहरों के आसपास का वातावरण भी इस समस्या का शिकार हो रहा है। बदलते वायु प्रदूषण का मुख्य कारण बढ़ती आबादी, शहरीकरण, औद्योगिकरण और अधिक मात्रा में हानिकरक प्रदूषक (pollutants) की वातावरण में उपस्थिति है जो कि मानव स्वास्थ्य पर गहरा असर डालते हैं। और मानव कई प्रकार की स्वास्थय सम्बन्धी बीमारियों से जूझता है जैसे - कि अस्थमा, lungs सम्बन्धी बीमारियां इत्यादि। वायु प्रदूषण के मुख्य कारणों में वाहनों द्वारा निकलने वाली हानिकारण गैसें, शहरीकरण के कारण घटता वानिकी क्षेत्र है । हरे पेड़ वायु प्रदूषण रोकने में सक्षम होते हैं, मगर इनकी संख्या दिन प्रतिदिन घटती जा रही है । जिसके कारण वातावरण में कई प्रकार के बदलाव नजर आ रहे हैं ।

वायु प्रदूषण को कम करने और हरियाली को पुनः स्थापित करने के लिए कई प्रयास किये जा रहे हैं, जिसमें मुख्य रूप से vertical garden system, sky garden green roof, green belt area शामिल हैं। इन स्थानों पर herbaceous trees, shrubs, climber plants avenue trees species, algae lichens का प्रयोग किया गया है। इन प्रजातियों का उपयोग शहरों की सौंदर्य को बनाये रखने के साथ प्रदूषण को कम करने में भी उपयोगी है ।

पर्यावरण प्रदूषण को कम करने के लिए कई सारी तकनीकें उपलब्ध हैं किन्तु हरे पेड़ पौधे प्राकृतिक रूप से पर्यावरण संरक्षण में मददगार है। प्रदूषण का मुख्य असर पेड़ों की पत्तियों पर पाया जाता है। पेड़ पौधे बिना अपनी वृद्धि को कम करते हुए प्रदूषण को कम करने का काम करते हैं, और स्वच्छ हवा एवं ऑक्सीजन प्रदान करते हैं। लेकिन जब पेड़ पौधे लगातार पर्यावरण के प्रभाव में आते हैं तो उनकी (functional physiology) में बदलाव देखे जाते हैं। पेड़ पौधों की प्रतिरोधक क्षमता और संवेदलषीलता उनके जैव रासायनिक गुणों को देखकर पता कर सकते हैं। इसके लिए वायु प्रदूषण tolerance index एक अच्छा माध्यम है, जिसमें पेड़ पौघों की प्रजाति के विभिन्न गुणों को देखा जाता है। जो इस प्रकार है:

Total chlorophyll content: जिसमें पत्तियों का नमूना लेकर 80 प्रतिशत एसीटोन की मदद से

chlorophyll extraction करके chlorophyll की मात्रा जांचेगे ।

Leaf extract pH

इसमें भी पत्तियों के नमूनों को 10 ml de-ionized water से homogenize करेंगे फिर centrifuge कर मिश्रण बनायेंगे और फिर नमूने का pH देखेंगे ।

Relative water content

इसके लिए पत्तियों के ताजे (fresh), turigid और सूखे वजन का माप करेंगे और फिर RWC निकालेंगे ।

RWC = (Fresh weight – dry weight) / Turgid weight – dry weight) × 100

Fresh weight - ताजी पत्तियों का वजन लेकर मापेंगे ।

Turgid weight - पत्तियों को कुछ घंटों के लिए distilled water में रखेंग और फिर वजन मापेंगें।

Dry weight - सूखी हुई पत्तियों के वजन के लिए, पत्तियों को blotted dry करेंगें, फिर वजन लेंगे।

Ascorbic acid content

इसके लिए पत्तियों के नमूनों को 4% Oxalic acid – EDTA extraction विलयन (solution) मिलाकर रखेंगे फिर 1 ml Orthophosphoric acid, 1 ml Sulphuric acid व 2 ml Ammonium molybedate & 3 ml water मिलाकर मिक्सर को क्रिया होने के लिए 15 मिनट रख देंगे और अंत में 760 nm पर visible spectrophotometer से absorbance लेंगे। फिर sample में Ascorbic acid की concentration, standard ascorbic acid curve से निकालेंगे।

Total Chlorophyll = 20.2 (A645) + 8.02 (A663) × V/ (1000 × W) mg/g

Where, A is Absorbance at specific wavelength (λ); V is Final volume of Chlorophyll extract in 80% acetone and W is Fresh weight of tissue extracted.

और अंत में इन सब पैरामीटर की मदद से हम ये नमूनों का APTI

APTI (Air Pollution Tolerance Index) = A (T+P) + R / 10

Where, A is Ascorbic acid (mg/g); T is Total chlorophyll (mg/g); P is pH of leaf and R is Relative water content (%)

इन जैव रासायनिक गुणों को माप कर प्रजातियों का APTI निकालते हैं। और इस आधार पर जिस प्रजाति का APTI अधिक होगा वह प्रजाति वायु प्रदूषण के लिए अधिक प्रतिरोधक होगी APTI का उपयोग प्रजाति की प्रतिरोधक और संवेदनषीलता पता करने के लिए करते हैं। पेड़ो में पाया जाने वाला cholorophyll प्राथमिक फोटो रिसेप्टर है। और पेड़ पौधे जब अधिक समय तक पर्यावरण प्रदूषण के सम्बन्ध में आते हैं तो उनकी प्रकाश संश्लेषण (photosynthesis) की गति भी बदल जाती है, वायु प्रदूषण के कारण cholorophyll धीरे धीरे घटने लगता है और पत्तियों का पीला पड़ना भी प्रदूषण की तरफ इषारा करता है । Water stress के दौरान chloroplast में reactive oxygen species (ROS) का निर्माण होता है जिसके कारण chlorophyll content घट जाता है और इसी

तरह Ascorbic acid की मात्रा पत्तियों की thylakoid membrane में oxidative damage से बचाने के लिए बढ़ जाती है क्योंकि Ascorbic acid, Photosynthetic apparatus को ROS के उत्पादन के खिलाफ बचाने में मदद करता है Ascorbic acid, antioxidant की तरह काम करता है।

इसी प्रकार यदि पत्तियों का ज्यादा pH acidic air pollutants tolerance की तरफ दर्षाता है। अधिक RWC पौधों के Protoplasmic permeability से जुड़ा होता है यदि पेड़ों में high RWC पाया जाता है तो पेड़ पौधे pollutants के लिए अधिक tolerant पाये जाते हैं।

प्रदूषण को कम करने और स्वच्छ साफ वातावरण बनाने में पेड़ पौधे ही सबसे अहम भूमिका निभाते हैं। आने वाली पीढ़ी को एक स्वच्छ और सुन्दर पर्यावरण प्रदान करना हमारी जवाबदेही है। बढ़ते प्रदूषण को कम करने के लिए अधाक से अधिक वृक्षारोपण जरूरी है। इस कार्य के लिए वृक्षों की वायु प्रदूषण के अधिक सक्षम प्रजाति ली गई है जिनका air pollution tolerance index (APTI) अधिक पाया है इन्हें प्रजातियों का चुनाव हमने स्मार्ट सिटी के पार्क, गार्डन, सड़कों के किनारे लगे वृक्षों, आवासीय परिसर जैसी जगहों से किया है और यहां पर लगाई गयी पेड़ों की प्रजातियों में कई प्रजातियों का अधिक पाया गया जो कि वायु प्रदूषण को रोकने के लिए एक अच्छा tool है। भारत में बढ़ता शहरीकरण, औद्योगिकिकरण, वाहनों द्वारा निकला धुंआ प्रदूषण को बढ़ा रहा है जिसे रोकने के लिए वृक्षारोपण जरूरी है। विभिन्न भारतीय शहरों में किये गये प्रयोगों में वाराणसी में, *Ipomoea palmate* (APTI-25.59), बैंगलूंरू *Azadiracta indica* (APTI-13.16) में, कोयम्बटूर में *Thespesia populnea* (APTI-16.07) उड़ीसा में *Cascabela thevetia* (APTI- 27.67) प्रजातियां प्रदूषण की तरफ प्रतिरोधक पायी गयी, और भी विभिन्न प्रजातियों जैसे कि *Holopetera integrifolia*, *Ficus glomerata* (15.02), *Nerium oleander* (16.65), *Magnifera indica* (80.52) सक्षम पायी गयी। ये प्रजातियां वाहन चालकों का यातायात के समय तनाव कम करने में और स्वस्थ्य जीवन प्रदान करने में मददगार है। साथ ही शहरी वानिकी बढ़ाने में भी मदद करती है। ये प्रजातियां carbon sink की तरह काम करती है जो हमारे पारिस्थितिकी तंत्र को संतुलित रखने में, प्राकृतिक संरक्षण, पर्यावरण बचाव, शहरों में तापमान को कम करने और शहरों की सौंदर्यत्मकता को बनाये रखने में मदद करती है। वृक्षारोपण के साथ साथ वाहनों से निकलने वाले हानिकारक गैसों में भी कमी लाने का प्रयास करना चाहिए। ताकि प्रदूषण को कम किया जा सके।

Summary

Greening with pollution-tolerant plants

The article discusses about choosing the best air-pollution tolerant plants (tree species) for plantation in cities especially -

road side plantation, avenues and residential colonies. In order to screen the best air-pollution tolerant plants, we do a series of biochemical analysis of leaves. Based on the relation between pH of leaf extract, relative water content, ascorbic acid and total chlorophyll, we derive Air Pollution Tolerance Index (APTI). APTI is used to screen best air-pollution tolerant plant species in a particular area.

Ficus glomerata

Azadiracta indica

Mangifera indica

Pongamia pinnata

Amarbel, *Cuscuta reflexa* Roxb. – An invasive alien species

N. Roychoudhury, Ram Bhajan Singh and Rajesh Kumar Mishra

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 : choudhury_nr@yahoo.com, mishrark@icfre.org

Abstract

The present article describes *Cuscuta reflexa* Roxb. (family Convolvulaceae), commonly known as giant dodder or amarbel, is one of the black listed invasive alien species of Mediterranean origin. Invasion of this invasive species on *Zizyphus mauritiana* at Silpua, Maharajpur Forest Range, Mandla Forest Division, Madhya Pradesh is recorded.

Key words: Amarbel, *Cuscuta reflexa*, Invasive alien species (IAS)

Introduction

An "invasive species" is defined as a species that is non-native (or alien) to the ecosystem under consideration and whose introduction causes or is likely to cause economic or environmental harm or harm to human health. The term invasive species refers to a subset of those species defined as introduced species. Human actions are the primary means of invasive species introductions. Those alien species that become established in a new environment proliferate and spread in ways that are destructive to human interests and natural systems are considered as Invasive Alien Species (IAS) (Goyal, 2005). IAS are characterized by one or more of the following traits: rapid growth rate, large reproductive output, efficient dispersal capabilities and tolerance of a broad range of environmental conditions. An invasive species typical of forest ecosystem is referred as Forest Invasive Species (FIS) (Roychoudhury and Sharma, 2013; Roychoudhury et al., 2019). FIS are of direct relevance to the forestry sector and serious threat to forest cover. FIS can displace native plants, eliminate food and forest cover for wild life and threaten endangered rare plant and animal species. According to the available information, there are about 190 alien plant species of invasive nature including FIS are found in India (Reddy, 2008; Reddy et al., 2008; Shukla et al., 2009). Among these, *Cuscuta reflexa* Roxb., a native of Mediterranean is one of the black listed IAS. The present article deals with this FIS and invasion of this invasive species on *Zizyphus mauritiana* at Silpua, Maharajpur Forest Range, Mandla Forest Division, Madhya Pradesh is recorded (Fig. 1).

Cuscuta reflexa Roxb. (family Convolvulaceae)

Cuscuta is a group of 100-170 species of yellow, orange, red or rarely green parasitic plants. *Cuscuta* belongs to the Cuscutaceae family and now on the basis of Angiosperm phylogeny group it is accepted as belonging to morning glory family, Convolvulaceae (Story et al., 1958). *Cuscuta* is found at the temperate and tropical regions of the world with huge species diversity in tropical and subtropical regions.

Cuscuta reflexa Roxb. is commonly called as the giant dodder (Anon, 2015), and also known as amarbel or swarnalata etc. It is a parasitic weed plant and also an extensive climber. This species grows as

Fig. 1: Invasion of Amarbel, *Cuscuta reflexa* on *Zizyphus mauritiana* at Silpua, Maharajpur Forest Range, Mandla Forest Division, Madhya Pradesh

homoparasite and it has very low level of chlorophyll and photosynthesis activity, completely depends over the host plant for its survival. This plant sucks nutrient sap from the host plant via vascular tissue of the host plant and grows itself. This plant has no roots in the ground and it grows over the host body without touching the ground surface in its complete life span (Dawson et al, 1994). *C. reflexa* has the ability not only to recognize its host plant but also to move towards its prey with significant precision and efficiency. Dodder plant can also choose an appropriate host between many plants on the basis of volatile compounds release by the host plant as their normal process of transpiration (Kapoor and Sharma, 2008).

Parasitism of *C. reflexa* is wrapping around itself over the host plant after attachment with host. *Cuscuta* makes haustorial connection with the vascular tissue of the host plant. This haustorium is able to penetrate the xylem and phloem of the host plant and attached with tissues of the host plant.

The flowers produce by *C. reflexa* varies in colour from white to pink. Flowers generally produced in the early summer and autumn but also depend on the species. Seeds are produced in the large quantities. Seeds of this plant can survive in the soil for many years in the search of appropriate host, at this time it depends on the food reserve in endosperm of the seed (Sarma et al, 2008). Various host plants of *C. reflexa* are *Argyreia argentea* var.

venusta (Choisy) C.B. Clarke (family Convolvulaceae), *Bougainvillea spectabilis* Willd. (family Nyctaginaceae), *Clerodendron viscosum* Vent. (Family Verbenaceae), *Jatropha curcas* L. (family Euphorbiaceae), *Lantana camera* L. (family Verbenaceae), *Mikania micrantha* (L.) Kunth. (family Asteraceae), *Ricinus communis* L. (family Euphorbiaceae), *Syzygium cumini* (L.) Skeels. (family Myrtaceae), *Vitex negundo* L, (family Verbenaceae) and *Zizyphus mauritiana* Lamk. (family Rhamnaceae) (Patel et al., 2012).

C. reflexa is a parasitic weed plant. This species causes a huge loss to the crop plants every year (Saini et al., 2015). Many countries have laws prohibiting import of dodder seed, requiring crop seeds to be free of dodder seed contamination. This species is used in producing traditional medicines for the treatment of headache, labour pain, bone fracture, fever, rheumatism etc (Patel et al., 2012; Saini et al., 2015; *O'Neill and Rana, 2019).*

References

Anonymous (2015). *Cuscuta reflexa*. Natural Resources Conservation Service *PLANTS Database*. USDA. Retrieved 19 December 2015.

Dawson, J. H., Musselman, L.J., Wolswinkel, P. and Dorr, I. (1994). Biology and control of *Cuscuta*. Review of Weed Science, 6: 265–317.

Goyal, A.K. (2005). Asia-Pacific Forest Invasive Species Network (APFISN). Available at : http://ifs.nic.in/rt/misc/apfisn/apfisn.htm

Kapoor, V. and Sharma Y.P. (2008). Host range of *Cuscuta reflexa* Roxb. in Jammu province of Jammu and Kashmir State, India. Indian Journal of Weed Science, 40(1): 98-100.

O'Neill, A.R. and Rana, S.K. (2019). An ethnobotanical analysis of parasitic plants (Parijibi) in the Nepal Himalaya. Journal of Ethnobiology and Ethnomedicine, 12(14). doi:10.1186/s13002-016-0086-y.

Patel, S., Sharma, V., Chauhan, N.S. and Dixit, V.K. (2012). An updated review on the parasitic herb of *Cuscuta reflexa* Roxb. Journal of Chinese Integrative Medicine, 10(3) : 249-255. DOI: 10.3736/jcim20120302

Reddy, C.S. (2008). Catalogue of invasive alien flora of India. Life Science Journal, 5(2): 84 – 89. http://www.lifesciencesite.com/lsj/life0502/16_life0502_84_89_Catalogue.pdf

Reddy, C.S., Bagyanarayana, G., Reddy, K.N. and Raju, V.S. (2008). Invasive Alien Flora of India. National Biological Information Infrastructure, USGS, USA. Available at : file:///C:/Users/hp/Desktop/IAS/assessment_Invasive_India-jan08.pdf

Roychoudhury, N. and Sharma, R. (2013). Invasive alien species with special emphasis on forest invasive species in India. In : Forest Health Management (Eds. A. Balu, R.S.C. Jayaraj, A. Regupathy, V. Mohan, R.R. Warrier, T.P. Raghunath and N. Krishnakumar). Institute of Forest Genetics and Tree Breeding, Coimbatore, Tamil Nadu, pp. 343-353.

Roychoudhury, N., Meshram, P.B. and Mishra, R.K. (2019). Invasive alien species. In : Cerificate course on Forest Entomology & Pest Control, under Green Skill Development Programme (GSDP), Government of India, Ministry of Environment, Forest and Climate Change (MoEF&CC), New Delhi. Tropical Forest Research Institute, Jabalpur, Madhya Pradesh, pp. 72-77.

Saini, P., Mithal, R. and Menghani, E. (2015). A parasitic medicinal plant *Cuscuta reflexa* : an overview. International Journal of Scientific & Engineering Research, 6(12) : 951-959.

Sarma, H., Sarma, C.M. and Bhattachariya, D.K. (2008). Host specificity of Cuscuta reflexa Roxb. In the manas biosphere reserve, indo-burma hotspot. International Journal of Plant Products, 2(2), 175-180.

Shukla, A.N., Singh, K.P. and Singh, J.S. (2009). Invasive alien species of Achanakmar-Amarkantak biosphere reserve, central India. Proceedings National Academy of Science - Section B: Biological Sciences, 79(4): 384-392.

Story, R. (1958). Some plants used by the Bushmen in obtaining food and water. Memoirs Botanical Survey of South Africa, 30: 1-115.

Contribution of GDP through NTFP and their marketing channels

Sreedhar Bodiga and Bollam sujatha

Department of Basic and Social sciences
Forest College and Research Institute,
Hyderabad, Mulugu @Mulugu, Siddipet District-502279

Introduction

The NTFPs play important role in the livelihood of millions of rural and urban people across the world. It is well established that NTFPs fulfil multiple functions in supporting human well being. Forest is nature's greatest bounty to mankind.

The forest products are classified into 2 categories.

1. Major forest products
2. Minor forest products (NTFP)

Minor forest products (Non -timber forest products):

All biological materials other than timber are called as NTFP's or minor forest products.

Importance of NTFP

The harvest of NTFPs remains widespread throughout the world. People from a wide range of socioeconomic, geographical, and cultural contexts harvest NTFPs for a number of purposes, including household subsistence, maintenance of cultural and familial traditions, spiritual fulfillment, physical and emotionalwell-being, house heating and cooking, animal feeding, indigenous medicine and healing, scientific learning, and income. The original idea on the potential of NTFP exploitation as a way to sustainable forest management was primarily based on the assumption that the commercial extraction of NTFPs from natural forests could simultaneously serve the goals of biodiversity conservation and poverty alleviation. Proponents of the 'NTFP-strategy' pointed to important benefits of NTFP exploitation for local communities, such as goods (food, fodder, fuel, medicine, construction material and small wood for tools and handicrafts), income and employment. Forest foods have high nutritional value than domestic animal or garden foods. The role of NTFPs in alleviating poverty, particularly for forest-dependent people, is now well recognized. They provide subsistence and cash income to millions of tribal and forest dwellers in India, as a major source of fuel, fodder, food, medicines, construction materials, and livelihoods. As the market for natural products is growing, particularly for medicinal and aromatic plants and organic mountain products, the sustainable harvesting and management of these products offers an immense opportunity to improve livelihoods of local communities as well as conserving resources in India.an immense opportunity to improve livelihoods of local communities as well as conserving resources in India.

Some of the important NTFP products

Some of the NTFP products based on their commercial importance in India may be divided into following classes:

Edible plant products

Fruits

Ziziphus jujube (regu) Artocarpus heterophyllus (Panasa), Diospyros melanoxylon (Tuniki fruit), Syzygium cumini (neredu), Cordia myxa (iriki fruit) nuts, starches (Sago), Mushrooms (Edible fungi)

Vegetables

Momordica dioica (Kartoli-akakara, boda kakara), Cassia tora (Takla-Leafy vegetable), Cassia fistula (Rela-Leafy vegetable)

Spices and condiments

Myristica fragrans (Nutmeg& mace – zajikaya & japatri) Syzygium aromaticum (Clove-Lavanga) Cinnamomum verum (Cardamom-dalchinachekka) Carumcarvi (Caraway)

Medicinal plants

Phyllanthus emblica (Amla-Usiri) Eucalyptus globulus (Nilgiri), Withania somnifera (Ashwagandha), Rauvolfiaserpentine (Sarpagandha), Azadirachta indica (Neem), Asparagus racemosus (Shatavari) Piper longum (Long pepper-pippallu)

Aromatic plants

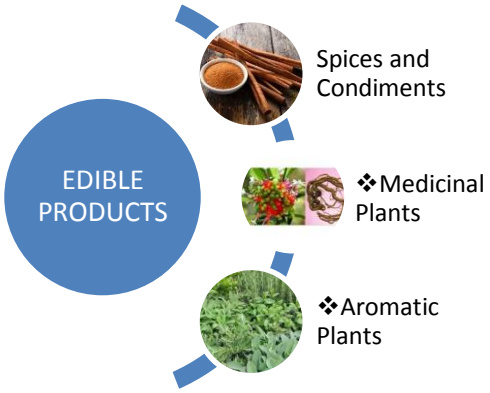
Artimellapallens (Dhavana) Pelargonium Sps (Geranium, Lemon grass (Cymbopogon flexosus) Mentha arvensis (Mint-pudhina), Chrysopogonzizaniodes (Vattiver), Pogostemoncablin (Patchouli-mint or deadnettle)

Oil yielding plants

Grass oil

Palmrosa grass oil-Cymbopogan martini (rosha grass), Cymbopogan flexosus (Lemon grassoil) Cymbopogan martini (Ginger grass oil) Cymbopogannardus (Citronella oil).

Wood oil: Sandalwood oil (Santalum album), Deodar wood oil (Cedrusdeodara)



Gum and resin exuding plants

Kavalamaurens (Gum karaya) *Anogeissus latifolia* (Thiruman), *Cochlospermum religiosum* (Konda gogu)

Tan yielding plants

Wood tan

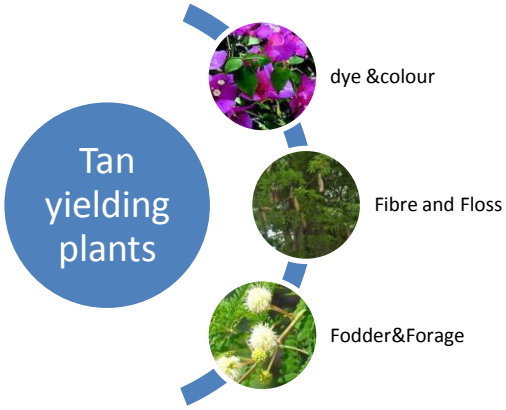
Acacia catechu (Kachu, katha)

Bark tan

Acacia nilotica (Babul)

Bark tan

Cassia auriculata



Dye and colour yield plants

Bark dye

Acacia farnesana (gand babul), Shorearobusta (Sal)

Flower dye

Butea monosperma (modhuga), Bougain villea glabra, Cassia auriculate (Tangedu, Tarwar)

Fruit dye

Aegle marmelos (Bel), *Terminalia bellerica* (Bahera)

Leaf dye

Acacia nilotica (Kikar), *Tectona grandis* (Teak)

Annatto, Roselle, Jamun, Pipal, Eucalyptus

Fibre and floss yield plants

Ceiba pentantra (silk cotton), cannabis sativa, callotropisprocera

Bamboo-Canes

Aundinaria gigantea, Dendrocalamus strictus)

Fodder and forage

Leucaena leucocephala (Subabul), *Wrightia tinctoria*

Fuelwood, charcoal making

White oak (Quercus alba), *Ostrya viriginiana* (Iron wood), Acacia sps

Bidi Wrapper Leaves

Other Leaves for plates

Diospyros melanoxylon (Tuniki), *Butea monospermal* (modhuga)

Beads for ornaments

Abrusprecatorius

Saponin and markingnut plants

Semicarpus anacradium

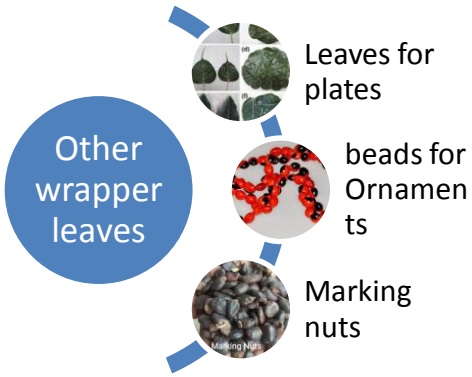
Animal origin

Honey, Lac, Tussar silk, Insects and Animal-Hides, Skins and Feathers, Horns, Bones and Shellac-Ivory and Musk

Important industrial uses of NTFP

Herbal and Drug Industry, Food and Flavour, Cosmeceuticals, Pulp and Paper, Katha and Cutch, Bamboo hand craft and Furniture making

Importance of value addition



Increasing product value through conservation and processing

Increasing cash income to local communities while simultaneously creating incentives for conservation of trees and forested ecosystems

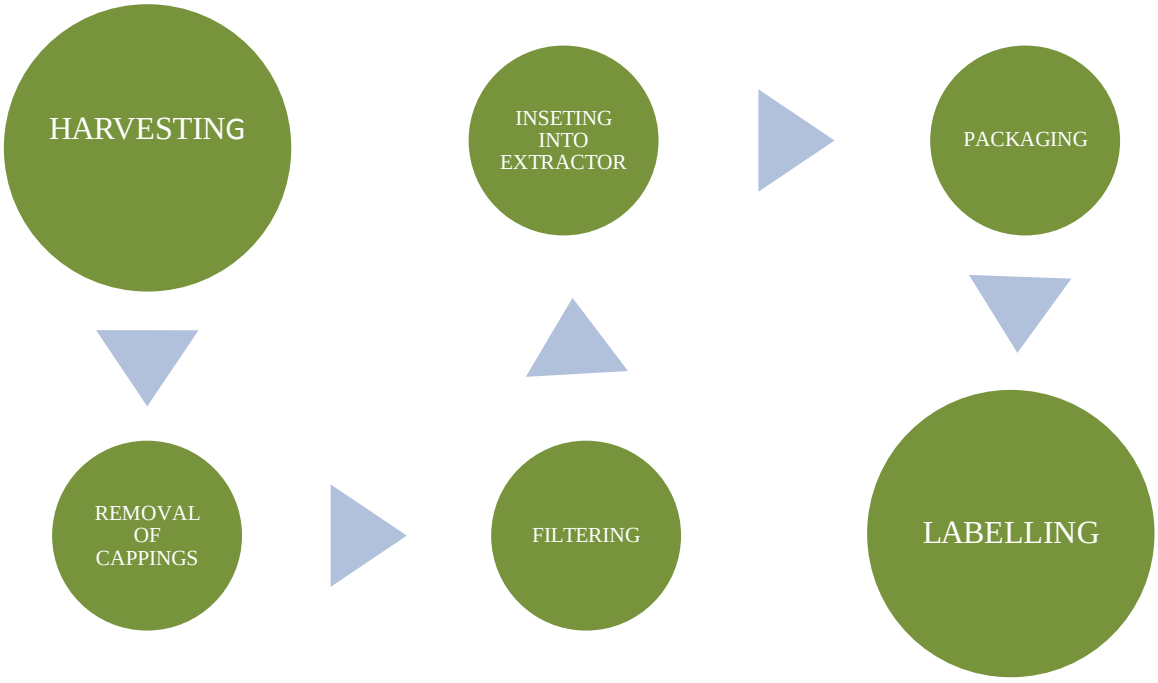
Value addition

Enhancement added to a product before reaching to a customer / economically adding value to a product to form characteristics more preferred in the market place.

Value Added

The additional value of a commodity over the cost of production process/ Extra features added to a product that go beyond the standard expectations and provide something more to satisfy the customer.

Example showing processing of honey for value addition



Marketing channels and supply chains

In India, out of the total land area of 329 million ha, only 78.29 million ha are classified as forests. This represents only 23.81 percent of the total geographic area as against the recommended forest coverage of 33 percent. The annual estimated production of wood and fuel wood from forests is estimated to be as 3.175 m cum and 1.23 m tones. India's rich biodiversity of 45,000 plant species is spread across 16 Agro-climatic zones. Out of these, about 3000 NTFP species yield are found but only 126 have developed marketability. These include medicinal plants, edible plants, starches, gums and mucilage's, oils & fats, resins & oleo-resins, essential oils, spices, drugs, tannins, insecticides, natural dyes, bamboos & canes, fibers & flosses, grasses, tendu leaves, animal products and edible products. In India over 50 million people are dependent on NTFPs for their subsistence and cash income. Minor forest products contribute about 50 percent to Indian government forest revenue and 70 percent of forestbased product exports. Commercial NTFPs are estimated to generate Rs. 3 billion (US$ 100 million) annually in India. a. It exports a large number of NTFP to other countries earning foreign exchange revenue to the tune of Rs. 10 billion (US $ 384 million) annually. Studies in Indian states of Orissa, Madhya Pradesh, Himachal Pradesh and Bihar have also indicated that over 80 percent of forest dwellers depend entirely on NTFP, 17 percent landless depend on daily wage labour mainly on collection of NTFP and 39 percent people are involved in NTFP collection as a subsidiary occupation. The NTFP market is highly complex with a large number of players at the producer, trader and manufacturer levels. There are number of agencies both at national and state level

mandated to help develop and facilitate marketing of NTFPs. Some if these include The Tribal Cooperative Marketing Development Federation of India Limited (TRIFED), National Medicinal Plant Board (NMPB), Ayurveda, Yoga and Naturopathy, Unani, Siddha and Homoeopathy (AYUSH) at the national level and Girijan Cooperative Corporation (GCC), MP MFP Federation, Chhattisgarh MFP Federation, Tribal Development Cooperative Corporation (TDCC).

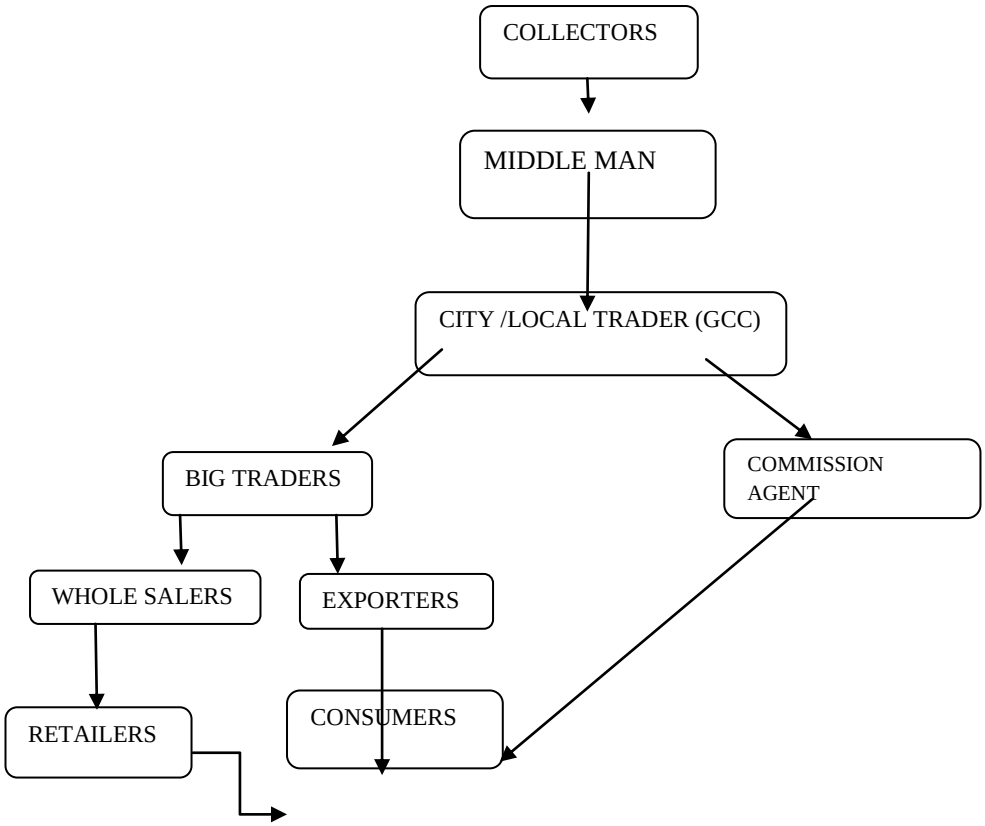
Marketing information system

The NTFPs value chains are complex, with multiple stages and actors involved in the process of getting a product from forest to consumer; they are also dynamic and change over time. Therefore, information about the quantity and quality of the product, price and their market is very important. Different types of information, such as price, value addition options and sustainable harvesting techniques are required by communities to increase their bargaining power and receive higher prices for their products. A social-networking forum must also be developed for exchanging market information within different stakeholders. To sell NTFPs at fair prices, forest dependent communities need access to an open and efficient market. Collective marketing approach as an NTFP based intervention can support communities with knowledge, confidence and processes to operate as a non-exploitative channel for the marketing of products. Creating such a market would generate higher revenues and offer a strong incentive for forest dependent communities to take on increasing responsibility for forest management and promote more efficient forest utilization

The contribution GDP through non timber forest products in India

The contribution of non-timber forest products (NTFPs) to the forestry sector in most countries is significant, and studies are showing that they have been undervalued in the past. A recent valuation undertaken by the Ministry of Environment and Forests in India estimates that 220 million tonnes of fuelwood, 250 million tonnes of grass and green fodder and 12 million m^3 of timber are removed from India's forests annually.In India, NTFPs provide about 40 percent of total official forest revenues and 55 percent of forest-based employment. Nearly 500 million people living in and around forests in India rely on NTFPs as a critical component for their sustenance Furthermore; revenues from NTFPs have been growing faster than revenues from timber in the past. For example, compound growth rates in revenue from NTFPs in India during the 1968/69 to 1976/77 period were 40 percent higher than those for timber. Export earnings from NTFPs on average account for about 60 to 70 percent of total export earnings from forest products, and this proportion has been rising. Moreover, there is considerable scope for increasing exports further by exploiting untapped resources as the current production of most NTFPs is estimated to be about 60 percent of the potential production. In the case of non-edible fibres and flowers, production is only 7 and 12 percent, respectively, of the potential production.

FLOW CHART OF MARKETING CHANNELS OF NTFP



Published by:

Tropical Forest Research Institute
(Indian Council of Forestry Research & Education)
(An autonomous council under Ministry of Environmnet, Forests and Climate Change)
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