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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.)

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From the Editor's desk

The process of Genetic Modification (GM) involves the direct transfer of DNA into the nucleus of the host genotype. It offers more rapid variety improvement than is possible with conventional brreeding. Production of GM trees will be most practicable where the technique can be applied to clones which are already of proven operational value. The first commercial use of GM trees will probably be herbicide tolerant eucalypts. Technical problems with more general uptake of GM technology include the practicability of cloning and the need to work with tested clones, which can be planted on an operational scale after GM, in order to provide a return on investment in reasonable time.

Over the past 20 years, DNA-based biotechnologies have been applied to agricultural production and many crops with new and useful attributes have been cultivated in various countries. The adoption of this new technology by farmers has been swift, and benefits in terms of increased production per unit land and environmental benefits are becoming obvious. In forestry, the application of biotechnology is somewhat lagging behind and to date there are no commercial plantations with genetically modified trees. However, most tree species used in plantation forestry have been genetically transformed, and results demonstrate the successful and correct expression of new genes in these plants. At the same time, this new technology is being viewed with concern, very similar to the concerns voiced over the use of genetic engineering in agriculture.

Trees, like genetically modified organism crops are being engineered to have new traits such as faster growth, insect and disease resistance, herbicide tolerance and altered wood composition.. The release of genetically modified trees could have unpredictable and irreversible consequences. GM trees pose an even greater risk of contamination than seen with GM crop plants, because trees live for decades, have so many nearby wild relatives and their pollen travels hundreds of miles.

In line with the above this issue of Van Sangyan contains an article on Genetically modified tress in forestry: Scope and threats. There are also useful articles viz.. किवांच (Mucuna pruriens): फली का संग्रहण, प्रसंस्करण एवं उपयोग, Air Pollution and possible remediation, Critical endangered species Bacopa monnierii - Micro propagation technique for large scale production, Water pollution – Its control, मध्यप्रदेश में वनवर्धन पद्धति के कार्य अभ्यास, Khamer defoliator, Calopepla leayana and its control measures and Environmental impact of melting glaciers

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

Chief Editor

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Genetically modified tress in forestry: Scope and threats

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Abstract

Genetic modification through transfer of gene can overcome the limitations of conventional tree breeding. Though first Genetically Modified (GM) forest trees trial reported in Belgium in 1988 for herbicide tolerance, currently more than 200 trials on at least 15 forest species have been doneespecially in poplar, eucalyptus and aspen. GM technologies in trees are used in modifying wood properties, speeding up breeding cycles, trees as pharmaceutical factories, dendroremediation and improving pest and disease resistance, as well as the restoration of sensitive landscapes. In this paper we present overview of scope, application, limitation and threats of GM trees in forestry sector.

Key Words: Genetic modification; GM trees; forest biotechnology; forestry; GMO

Introduction

Trees are the important resource on the earth which make up more than 30 % of the land biosphere and play an essential part in our lives by photosynthesizing, cleaning the air, and contributing to the beauty of landscapes as well as being a major source of fuel and processed products. Traditional approaches to tree improvement have involved the identification of mature trees with desirable phenotypes, followed by their incorporation into breeding programs. The application of biotechnology can overcome many of the drawbacks associated with conventional breeding strategies. There is enormous potential for speeding up tree breeding cycles by the use of genetic modification. Genetic modification or engineering allows the direct transfer of genes between organisms of entirely different species or kingdoms that would not breed naturally in contrast with to conventional breeding and hybridization *i.e*. producing genetic blueprint by insertion of foreign DNA or gene in trees on the molecular level.

Selection and characterization the genetically modified tissues before regenerating them via shoots into new trees are necessary for application of GM technology in trees. Expression of a selectable marker gene is used to identify genetically modified cells. The most widely used selectable marker genes include neomycin phosphotransferase II (npt II) encoding resistance to the antibiotics kanamycin and G418, and resistance to herbicides such as glyphosate (Hansen and Wright 1999). Alternative selectable markers based on existing

metabolic pathways have recently emerged. Expression of these counter selection markers typically leads to the formation of toxic metabolites in unmodified cells (Daniell and Dingra 2002).

First Genetically Modified (GM) forest trees trial reported in Belgium in 1988 for herbicide tolerance. Currently more than 200 trials on at least 15 forest species have been done, of which majority of done in USA. Nearly 77% of trials carried out in hardwood especially in poplar, eucalyptus and aspen. Herbicide tolerance, marker genes and insect resistance were major target characteristics for genetic modification. Currently only China allowed commercial production and plantation of GM trees for *Populus nigra* with the Bt gene (Valenzuela *et al*., 2006) although field trials are underway in Chile, Indonesia, South Africa, New Zealand and China.These technologies lead to applications including modifying wood composition and structure, manipulating growth and development, improving pest or disease resistance and landscape restoration.

Scope

1. Production of more wood with less environmental impact by use of GM (Pena and Seguin, 2001).
2. GE trees will fulfilfuel, fibre and lumber demand sparing natural forest thus saving nature.
3. Insect resistance is one of the major traits of GE crops.
4. Less use of pesticides.
5. Increased supply of food with reduced cost and longer shelf life.
6. Faster growing plants
7. Disease- and drought-resistant plants that require fewer environmental resources

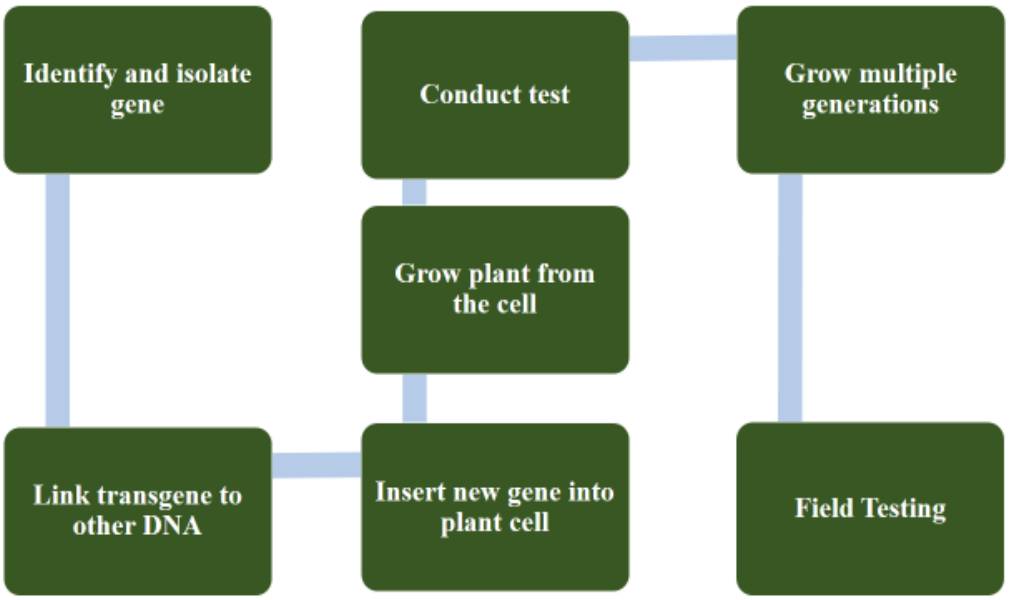

Fig. 1: Process of Genetic modification in trees.

Advantages

1. Domestication of trees: making them better suited to growing in

cultivated environments of plantation.

2. Producing GM trees tailored to the consumer will have environmentally friendly spin-offs.
3. Very low risk for human health and food safety due to non-food entity
4. GM trees can increase productivity of short rotation tree plantations to fulfil growing demand for wood products and save large areas of natural forests from intensive harvesting.

Applications

1. **Improved yields**- Trees produced with no reproductive organs are designed to transfer growth to the wood fibre, engineered to grow 40% faster for use as paper, as fuel. Fast growing eucalyptus and poplar developed by *FuturaGen* Company, by incorporating gene from fast-growing Arabidopsis weed can grow 5 meters a year. Two species of aspen (*Populus tremuloides* and *P. tremula*) grow faster after genetic modifications (Hu *et al*. 1999). Increasing yields from plantation forests by genetic modification will allow more wild forests to be left undisturbed. GM trees can be industrial game changer and boost global green economy in future.
2. **Modifying lignin content**- composition and processing properties of lignin can be modified using antisense technology to reduce expression of 4-coumarate:coenzyme A ligase, a key step in lignin biosynthesisor by reducing cinnamyl alcohol dehydrogenase activity (Lapierre*et al.* 1999). Reductions of up to 45% in the lignin content and increases of up to 15% in the cellulose content have been obtained in aspen. (Hu *et al*. 1999).
3. **Speeding up breeding cycles**- expression‘apetela 1’ gene from *Arabidopsis thaliana* in trees has shortened generation time in aspen, reducing flowering time to a mere 7 months (Martin and Zapater, 2002).
4. **Production of valuable pharmaceuticals from trees**-This is still at an early stage, In Malaysia, rubber trees have been genetically modified to secrete human serum albumin. In future other high-value commodities like vaccines in fruits can be produced and easily harvested from GM trees.It may become commercial realities in due course (Langridge 2000).
5. **Resistance to pests and diseases**- Resistance to the cottonwood leaf beetle may soon be possible among poplars following their genetic modification with Bt toxin genes (James *et al*., 1999).
6. **Enhanced amenity and landscape restoration value**-Identification of potential genes for resistance to any diseases and transferred back such genes into the trees by genetic modification, to restore trees to pest-damaged landscapes.
7. **Dendroremediation**- Using trees to clean up environmental pollutants. *Liriodendron tulipifera* is modified to express bacterial mercuric reductase enzyme, grows vigorously in normally toxic levels of ionic mercury, being able to convert the highly toxic ionic mercury to the much less toxic elemental form up to twelve times faster than untransformed poplars (Rugh 2001).

Threats of GM trees

International non-profit organization, Forest Stewardship Council that promotes environmentally appropriate, socially responsible and economically viable management of forests has identified the imminent threat of GM trees to biodiversity. Thus it prohibits GM trees and also not certify any forest containing field trials of GMOs.

1. **Environmental problems**: A corresponding increase in GM herbicide tolerant tree encourages large scale application of chemicals. When applied to large areas of plantation inevitably increases human and environmental exposure to the chemicals. Furthermore, widespread eradication of undergrowth leads to a host of environmental problems, from loss of species habitat to erosion and soil leaching.
2. **Inaccurate and unpredictable results**: pest resistant GM poplar was attacked two years later by insects that were previously unknown as a pest in unmodified poplar trees.
3. **Anticipated build-up of resistance by target insect populations:** making the toxin useless as a pest control agent in future.
4. **Exporting risk to third world**: GM trees resistant to the European shoot moth developed by GenFor in New Zealand shipped to Chile for field trials and commercialization(Rautner, 2020)
5. **Threat of new invasive species:** GM trees can be transformed into new invasive species in future.
6. **Potential for trees to spread pollen:** Trees live for many years and their pollen spreads of hundreds of miles. GE trees will contaminate forests, can devastated forest and biodiversity. Use of sterile GM trees can be an alternative to minimize vertical gene flow but fewer amounts of flowers itself could have a negative impact on insects or birds which feed on them. Sterility technology remains elusive, so risk of gene flow to the wild remains (Adams et al. 2002). Trees, have been exchanging genetic material within and between species on a large scale for millions of years. As yet, this exchange does not appear to have produced large-scale ecological problems. Recently study suggested that GM poplar DNA is unlikely to persist in soils for more than 4 months before being degraded, limiting potential for transfer to soil based microbes (Hay et al. 2002).

Limitations

1. Stability of transformations**:** due to logetivity, trees are exposed to many environmental stresses that can trigger gene silencing so trees may react by turning off some of their genes. Although frequency of gene silencing events is rare (Dominguez et al. 2002a).
2. Economical restrictions,
3. GM tree field trials have not been able to last longer, due to boycotts of different environmentalists groups and to different types of certification like Forest Stewardship Council.
4. Lignin is an important in the defence against insects and disease. Low-lignin trees would be more susceptible to disease and pests and would be vulnerable in windstorms. The spread of low-lignin trees and their genes via seed and pollen to forests could be devastating.Halpin*et al*., 2007 conducted trials on GM poplar and

reported that normal and healthy growth of trees throughout four year. He also found that Interactions of trees with soil organisms, pathogens and leaf-feeding insects were not affected but the short-term decomposition of transgenic roots was slightly enhanced due to low lignin. This short-term study indicated that lignin modifications had no unexpected biological or ecological impacts but long duration study is needed to draw any conclusion.

Conclusion

GM technology is still a relatively new tool in forestry; as a tool, it has potential benefits and drawbacks but it not intrinsically good or bad. Regulatory framework for testing, monitoring and management of GMOs are essential. It's important to consider the possible unintentional side-effects when evaluating the potentials ecological risks and benefits associated with commercialization of GM trees. Till sufficient body of knowledge on the anticipated benefits and the possible risks of GM technology not established case by case basis, environmental risk assessment should always be carried out.

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किवांच (*Mucuna pruriens*) : फली का संग्रहण, प्रसंस्करण एवं उपयोग

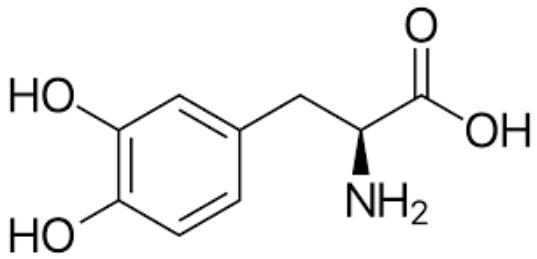
संतोष कुमार चौबे, हरिओम सक्सेना एवं गनेश पवार

अकाष्ठ वन उत्पाद अनुभाग, वन संवर्धन, वन प्रबंधन एवं कृषि वानिकी प्रभाग
उष्णकटिबंधीय वन अनुसंधान संस्थान
(भारतीय वानिकी अनुसन्धान एवं शिक्षा परिषद्, पर्यावरण, वन एवं जलवायु परिवर्तन मंत्रालय, भारत सरकार)
जबलपुर (म.प्र.)- 482021

परिचय

किवांच एक महत्वपूर्ण औषधि पौधा है। एक किवांच औषधि के रूप में प्रयुक्त होती है जिसका वैज्ञानिक नाम मुकुना प्रुरियंस है एवं दूसरी किवांच जिसका सब्जी के रूप में उपयोग किया जाता है I औषधि किवांच को कौंच, कपिकच्छु, काउहैज, कोवंच, अलकुशी, कौंचा, कवच, मखमली सेम यानी वेलवेट बीन्स के रूप में भी जाना जाता है । यह मैदानी भागों में पायी जाने वाली एक जंगली बेल है । किवांच के बीज, पत्ते, रोम, जड़ और फली सभी औषधि उपयोग में आते है । बीज की फली की परत वाले बालों में सेरोटोनिन या म्यूसिन और प्रोटीन श्लेष्मा होता है । फली को छूने पर बहुत अधिक खुजलाहट होती है । किवांच बीजों का विशेष उपयोग मूत्र विकारो एवं शारीरिक दुर्बलता में किया जाता है । इसकी एंटी डायबिटिक, कामोत्तेजक, एंटी-नियोप्लास्टिक, एंटी-मिर्गी, और एंटी-माइक्रोबियल उपयोग में जांच की गई है। किवांच बीज एमिनो एसिड L-3, 4 -डिहाइड्रॉक्सी फेनिल ऐलेनिन (L-DOPA) का एक प्राकृतिक स्रोत है, न्यूरो ट्रांसमीटर डोपामाइन का प्रत्यक्ष अग्रदूत है जो पार्किंसंस रोग (पीडी) के उपचार में व्यापक रूप से उपयोग किया जाता है।

किवांच फली एवं किवांच बीज



एल - डोपा की रासायनिक संरचना

भौगोलिक वितरण

किवांच भारत के समस्त मैदानी प्रदेशों में, ज्यादातर हिमालय के निचले हिस्सों में होती है। मध्य भारत में भी प्रचुर मात्रा में पायी जाती है।

वानस्पतिक वर्गीकरण (वर्गीकरण पादप)

किंगडम	प्लांटी
उप-किंगडम	ट्रेकेओबिओन्टा
डिवीजन	मग्नोलिओफाइटा
कक्षा	स्पेर्मेटोप्सीडा
ऑर्डर	फेबल्स
परिवार	फैबेसी
जीनस	मुकुना
प्रजाति	एम प्रुरिएंस

किवांच का रूपात्मक चरित्र

पत्ते

इसके पत्ते 6 से 9 इंच लम्बे लट्टूवाकार और स्पष्ट पर्शिविक सिराओं से युक्त होते है | पत्तियाँ त्रिपर्णक व पर्णक अण्डाकार तथा रोमिल छोटे है|

फूल

किवांच के फूल 1 इंच लम्बे नील और बैंगनी रंग के होते है|

फली

इसकी फली 5 से 10 सेमी. लम्बी होती है जिसके प्रष्ठ भाग पर सघन रोम और पर्शुक होते है, इसी फली में अन्दर 5 से 6 काले रंग के बीज होते है जिन्हें किवांच बीज कहा जाता है|

किवांच का रासायनिक संगठन

इसके बीजों में आद्रता 9.1%, प्रोटीन 25.03%, डोपा 1.5% और खनिज पदार्थ 3.95% होते है| इसके अलावा बीजो में ग्लुताथायोंन, लेसिथिन, गैलिक एसिड, ग्लूकोसाइड, निकोटिन, प्रुरियेनिन आदि पाए जाते है | इसके बीज से एक गाढ़ा तेल निकलता है|

किवांच के गुण

किवांच का रस मधुर एवं तीक्ष्ण होता है। इसके बीजों की तासीर गर्म होती है। यह वातशामक और कफपित्त वर्धक भी है|

किवांच के फलियों को संग्रहण करना

किवांच फलियों में खुजली करने वाले रेशे होते है, इसीलिए फलियों को सावधानी पूर्वक एकत्रित करना चाहिए। फलियों के ऊपरी सतह पर रेशे होने के कारण इसे वेलवेट बिन्स भी कहते है। किवांच की फली जनवरी -फरवरी माह में पक कर तैयार हो जाती है। फलियों को इक्कट्ठा करने से पहले पॉलीथिन से बने पोशाक, हाथो में पॉलीथिन के दस्ताने एवं सिर को अच्छी तरह से ढक लेना चाहिए इसके पश्चात् ही फलियों को एकत्रित करना चाहिए।

किवांच के फलियों को संग्रहण करना

प्रसंस्करण

किवांच के फलियों से बीजों को अलग करना

किवांच फली से बीजों को निकालने के लिए बहुत सावधानी की आवश्यकता होती है । पकी फलियों में रेशे एवं काले बीज होते है, रेशे होने के कारण शरीर के किसी भाग पर लग जाने से खुजली हो सकती है। अतः बीजों को सावधानी पूर्वक निकालना चाहिए। बीजों को निकालने की विधियाँ इस प्रकार हैं -

किवांच फलियों को धूप में सूखाकर

किवांच फलियों का धूप में सूखना

पकी फलियों को दूर खाली मैदान या खुले स्थान पर धूप में कुछ दिनों के लिए छोड़ देते है। जिससे फली बीच से चटक कर अपने बीज से अलग हो जाती है। इसके बाद दस्ताना पहन कर बीजों को अलग कर लेते है।

गोबर के घोल से

गाय या भैस के गोबर को बाल्टी या टब में पानी के साथ घोल बना लेते है, तत्पश्चात रेशेदार पकी फली को गोबर के घोल में एक से दो घंटे के लिए डुबा देते है जिससे रेशे मुलायम हो कर गोबर के घोल में रह जाते है। दस्तानो की मदद से फलियों से बीजों को अलग कर, स्वच्छ पानी से बीजों को धोकर हवादार स्थान पर सुखा लेते है।

गरम पानी से

एक बड़े पतीले या गंज में जिसमे 15 से 20 लीटर पानी डालकर गर्म कर लेते है। उसके बाद पकी हुई फली को गर्म पानी में कुछ समय के लिए छोड़ देते है। जिससे फलियों के रेशे पानी में रह जाते है। रेशे रहित फलियों को बर्तन से बहार निकाल कर दस्तानो की मदद से फलियों से, बीजों को अलग कर हवादार स्थान पर सुखा लेते है। **किवंच फली का प्रसंस्करण**

किवांच बीज के पौष्टिक तत्व

किवांच बीज में निम्नलिखित प्रमुख पौष्टिक तत्व पाये जाते

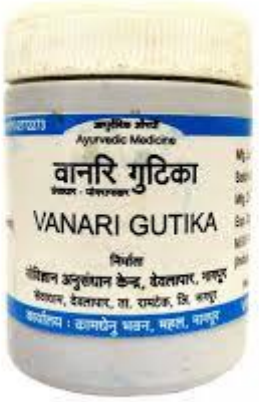
प्रमुख तत्व	मात्रा (मिली ग्राम)
सोडियम	43.1-150.1
पोटैशियम	778.1-1846.0
कैल्शियम	393.4-717.7

मैग्नीशियम	174.9-387.6
फास्फोरस	98.4-592.1
आयरन	10.8-15.0
कॉपर	0.9-2.2
जिंक	5.0-10.9
मैंगनीज	3.9-4.3

किवांच बीज के औषधीय उपयोग

आयुर्वेद चिकित्सा में इससे वानरी गुटिका, किवांच पाक आदि औषधि बनायी जाती है।

किवांच पाक



वानरी गुटिका

- किवांच पाक के इस्तेमाल से शारीरिक दुर्बलता दूर करने में उपयोगी है और यह आपके पाचन, स्मृति और शारीरिक बल को बढ़ाता है।

दुर्बलता में

किवांच के बीजों को सबसे पहले दूध में पका कर इनका छिलका उतार दे| फिर इसे धूप में सुखा कर तथा सामान मात्रा मे अश्वगंधा और सफेद मूसली का महीन चूर्ण लेकर आपस में मिला लेते हैं इसके पश्चात् रोज सुबह और शाम 5 ग्राम की मात्रा में दूध में मिश्री मिलाकर इसका सेवन करने से शरीर की दुर्बलता दूर हो जाती है।

अनिंद्रा के लिए

सभी के लिए पर्याप्त नींद लेना जरूरी है। अगर नींद पूरी नहीं होती है, तो न सिर्फ शारीरिक, बल्कि मानसिक समस्याएं भी होने लगती है। इन समस्यों का निराकरण करने के लिए सफेद मूसली के साथ किवांच का सेवन किया जाए, तो अनिद्रा की समस्या से निजात पाया जा सकता है।

पार्किंसंस रोग के लिए

किवांच का बीज पर्किंसंस रोग के लिए भी बहुत असरदार है। पर्किंसंस रोग तंत्रिका तंत्र से जुड़ी बीमारी है, जिसमें मरीज को कंपकंपी, शरीर में दर्द व चलने-फिरने में परेशानी हो सकती है। मुख्यत: यह बीमारी उम्र बढ़ने पर होती है, लेकिन कभी-कभी यह भी देखा गया है कि कम उम्र के व्यक्ति को भी हो जाती है। इस स्थिति में किवांच अच्छा विकल्प है। इसमें एंटी-पार्किंसंस गुण मौजूद हैं, क्योंकि इसमें एल-डोपा (L-dopa) नामक एमिनो एसिड मौजूद होता है। इससे पार्किंसंस की समस्या पर काफी प्रभाव पड़ सकता है ।

शरीर या कमर में दर्द के लिए

किवांच कमर दर्द के लिए भी फायदेमंद औषधि है । इसमें मौजूद एंटी-इंफ्लेमेटरी और एनाल्जेसिक

(analgesic) यानी दर्दनाशक गुण दर्द से राहत दिलाने में मदद कर सकते हैं।

एकाग्रता के लिए

किवांच को पार्किंसंस जैसे तंत्रिका तंत्र से संबंधित समस्या का इलाज करने के लिए वर्षों से उपयोग किया जा रहा है। यह मनुष्य को दिमागी तौर पर मजबूत बनाता है और मस्तिष्क को तेज बनाता है । जब मनुष्य मानसिक तौर पर स्वस्थ होगा, तो उसकी एकाग्रता क्षमता में भी सुधार हो सकता है।

दमा के लिए

दमा के उपचार में किवांच की औषधि कारगर साबित हो रही है। यह एंटी-हिस्टामिनिक की तरह काम करता है और एलर्जी से बचाव करता है ।

तनाव से बचाव के लिए

तनाव की परेशानी से बचाव के लिए किवांच का सेवन किया जा सकता है। किवांच में एंटी-डिप्रेसेंट (Antidepressant) प्रभाव होता है, जो तनाव को कम करता है ।

मिर्गी के लिए

किवांच का सेवन मिर्गी में मददगार साबित हो रहा है, किवांच में एंटी-एपिलेप्टिक गुण मौजूद होते हैं।

साइटिका के लिए

किवांच का दर्दनाशक गुण साइटिका के दर्द को कम करता है ।

मोटापा कम करने के लिए

किवांच मोटापे को कम करने के लिए मददगार साबित हो सकता है, क्योंकि यह एंटी-ओबेसिटी प्रभाव डालता है।

डायबिटीज के लिए

शोध के अनुसार किवांच बीज का उपयोग मधुमेह के उपचार में किया जाता है, क्योकि इसमें एंटी-डायबिटिक तत्व पाये जाते हैं ।

एंटीऑक्सीडेंट के रूप में

किवांच का बीज एंटी-ऑक्सीडेंट एवं एंटी-इंफ्लेमेटरी गुणों से भी भरपूर है । इसलिए, यह स्वास्थ्य के लिए बेहद फायदेमंद है I

किवांच बीज को इस्तेमाल करने के विभिन्न तरीके

- किवांच बीज का काढ़ा बनाकर सेवन किया जा सकता है।
- किवांच के बीज दवा के रूप में मेडिकल स्टोर में भी उपलब्ध होते हैं। आप इसे कैप्सूल या टैबलेट के रूप में भी सेवन कर सकते हैं। किवांच बीज का चूर्ण भी बाजार में उपलब्ध है, तो आप इसका सेवन दूध या पानी के साथ भी कर सकते हैं।

किवांच के बीज से हानियाँ

किसी भी औषधि से लाभ और हानियाँ दोनों हो सकते है इसलिए इन का उपयोग निश्चित अनुपात में किया जाना चाहिए। किवांच के बीज के नुकसान कुछ इस प्रकार हैं:

- किवांच के बीज के ज्यादा सेवन से वजन बहुत कम हो सकता है। इससे उल्टी, दिल की धड़कन में समस्या या भूख की कमी हो सकती है। इसलिए इसका निर्धारित मात्रा में ही सेवन करे।
- इस कारण कमजोरी की समस्या हो सकती है। किवांच बीज से दस्त की परेशानी हो सकती है। गर्भवती या स्तनपान कराने वाली महिलाएं इसके सेवन से बचें। या फिर चिकित्सक की सलाह के बाद ही इसका सेवन करना चाहिए।

- अगर किसी को कोई स्वास्थ्य संबंधी समस्या है, तो वो लोग भी इसका सेवन से पहले डॉक्टर की सलाह अवश्य लें।
- बच्चों को यह खाने के लिए न दें और बच्चो से दूर रखे। मधुमेह के मरीज भी इसका सेवन कर सकते हैं, लेकिन अगर आप डायबिटीज की दवा ले रहे हों, तो किवांच का सेवन करने से पहले डॉक्टर से भी सलाह ले लें।
- किवांच के साथ क्या खाना चाहिए और क्या नहीं, इस बारे में डॉक्टर से जरूर पूंछना चाहिए।

Air pollution and possible remediation

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Introduction

Pollution is derived from Latin word "pollure" which means to defile. Pollution is a negative/undesirable change in the environment, usually the addition of something hazardous or detrimental. It is the man-induced change leading to deterioration of natural environment in quality. According to the environmental campaign organization (WWF), Pollution from toxic chemicals threatens life on this planet. Every ocean and every continent, from the tropics to the once-pristine polar regions, is contaminated." The introduction of pollutants, the elements of pollution causes harm or discomfort to the ecosystem including changes in the abundance of species interruption to energy and nutrient flows, modification of habitats, reduction of air, water and soil quality and changes in the stability and resilience of the ecosystem (Banerjee 2010).

Pollution is drastically rising in all the countries due to rise in human activity associated with modern technology and population growth. Development activities such as construction, transportation and manufacturing not only deplete the natural resources but also produce large amount of wastes that leads to pollution of air, water and soil, the three natural resources of the earth. The five elements of the life support system viz., air, water, land, flora and faunae are inter-related and inter-dependent and the entire process is self generating and auto-sustainable. As long as man, as a part of this system, worked in harmony with nature and used the resources for its normal sustenance, damage to the system was minimal. With the process of development, human activities assumed such enormous dimensions that the life support system could no longer sustain these. Accordingly, the waste generated through human activities was much more than the system could absorb or assimilate. This has resulted in the problem of pollution (Banerjee *et al.* 1998.). Pollution poses health hazards, endangers wild life and makes the ecosystems unsafe for future human survival.

A pollutant is a waste material that pollutes or damages the environment which can come in the form of chemical substances or energy such as noise, heat or light. It is a by-product of human activities which enters or becomes concentrated in the environment, where it may cause injury to humans or desirable species and is one of the greatest problems that the world is facing today, increasing with every passing year and causing grave and irreparable damage to the earth. Three factors determine the severity of a pollutant: its chemical nature, the concentration and the persistence. Some pollutants are biodegradable and therefore will not persist in the environment in the long term.

Air pollution

Earth's atmosphere is composed of air. Air is a mixture of gases, 78% nitrogen and 21% oxygen with traces of water vapour, carbon dioxide, argon, and various other components. We usually model air as a uniform (no variation or fluctuation) gas with properties that are averaged from all the individual components. Average composition of the atmosphere up to an altitude of 25 km is given below. According to WHO, an increase in any of the constituents of the atmosphere which is harmful to the living beings and their environment, is known as air pollution.

Average composition of the atmosphere up to an altitude of 25km (Pidwirny, M. 2006)

Gas Name	Chemical Formula	Percent Volume
Nitrogen	N_2	78.08
Oxygen	O_2	20.95
Water*	H_2O	0 – 4
Argon	Ar	0.93
Carbon dioxide*	CO_2	0.0360
Neon	Ne	0.0018
Helium	He	0.0005
Methane	CH_4	0.00017
Hydrogen	H_2	0.00005
Nitrous oxide*	N_2O	0.00003
Ozone*	O_3	0.000004

*Variable gases

According to WHO, an increase in any of the constituents of the atmosphere which is harmful to the living beings and their environment is known as air pollution. Air pollution is the introduction of particulates, biological molecules, or other harmful materials into Earth's atmosphere, causing disease, death to humans, damage to other living organisms such as food crops, or the natural or built environment. Air pollution may come from anthropogenic or natural sources. It is the contamination of the indoor or outdoor environment by any chemical, physical or biological agent that modifies the natural characteristics of the atmosphere (WHO 2014). It is a gas (or a liquid or solid dispersed through ordinary air) released in a big enough quantity to harm the health of people or other animals, kill plants or stop them growing properly, damage or disrupt some other aspect of the environment (such as making buildings crumble) or caused some other kind of nuisance. Pollutants of major public health concern include carbon monoxide, sulphur dioxide, nitrogen oxides, ozone, chlorofluoro carbons (CFCs), etc. produced by industries, power plants, motor vehicles etc. The most dangerous forms of outdoor air pollution is the particulate matter from coal burning power plants and diesel vehicles. Volatile organic compounds (hydrocarbons, alcohols, aldehydes, ethers etc.) may affect human and animal health directly or indirectly as contributors to the formation of ozone and are emitted by industrial processes and vehicles. Persistent organic pollutants (POPs) are resistant to degradation and persistent in the environment. They may affect human and wildlife species including certain kinds of fish, birds and mammals through food chain, environmental exposure or accidents (Francis, 2004). In the troposphere, chemical reactions involving air pollutants create poisonous gas ozone. Ground level ozone or "bad" ozone comes from the pollutants which result from industrial activities, transport and some natural sources.

Lead is a solid and highly toxic metal. Its compounds are emitted into the

atmosphere as a particulate matter. Human sources are paint, smelters, lead manufacture, and storage batteries, leaded petrol etc. Lead accumulates in the body and brain leading to nervous system damage and mental retardation, digestive and other health problems. It can harm wildlife.

Effects

Adverse air quality can kill many organisms including humans. Near power plants, where fly ash, sulphur dioxide and oxides of nitrogen are the main air pollutants, man and animal living in and around the area suffer from many diseases like silicosis, fluorosis, asbestosis, managanism, plumbism, itai-itai etc. (Table 1). These pollutants have an adverse effect on plant growth also (Table 2), where fly ash is one of the main air pollutants, density of stomata, the stomatal index and size of stomatal pore and epidermal cells of plants decrease. Dry matter production, photosynthesis and respiration are found to be reduced and, as a result, productivity of the forest stand and agricultural crops is reduced (Gupta and Ghouse 1986). Phytotoxic effects of air pollution may be classified into visible and subtle effects. Visible effects are marked by necrotic and chloratic patches and/or yellowing of leaves resulting from physiological disturbance of plant cells whereas subtle or invisible effects lead to decreased yields and lower quality of plant products (Guderian 1975).

Table 1. Air pollutants and their effects on human health

Pollutants	Sources	Effects
Sulphur dioxide	Coal and oil combustion	Chest congestion, vomiting, irritation and death from respiratory diseases
Carbon monoxide	Gasoline motor exhaust	Reduction in oxygen carrying capacity of blood
Nitrogen oxides	Motor vehicle exhaust and soft coal burning	Inhibition of cilia action causing penetration of soot and dust far into the lungs and increase in acute respiratory disease
Aldehydes	Thermal decomposition of fats, oils and glycerol	Causes diseases related to nasal and respiratory tracts
Hydrogen sulphide	Refineries, chemical industries, bituminous fuels, and sewage manholes	Irritation of eyes and throat
Hydrogen fluoride	Aluminium and fertilizer production plants, refineries	Irritate and corrode all body passages
Chlorine		Attack entire respiratory tracts and mucous membranes of eyes and

		also causes pulmonary edema
Suspended particles (shoot, ash, smoke)	Incinerators, power plant and every manufacturing processes	Causes emphysema, eye irritation and also bysinosis and cancer

Table 2. Effects of air pollutants on plant leaves

Air pollutants	Type of damage
Sulphur dioxide	Interveinal chlorosis
Nitrogen oxides	Defoliation, marginal and tip burning, irregular black spots
Ozone	White or yellow or brown flecks on upper surface of leaf associated with stomata
Hydrogen fluoride	Tip burn or marginal necrosis
Hydrogen sulphide	Whitish or tan marking on young growing leaves
Carbon monoxide	Leaf curling, aging and reduction in leaf size
Photochemical oxidants	Reddish brown flecks
Particulate oxidants	Clog stomata preventing gas and vapour exchange

Air pollution has been a serious problem for the forests. The chief agent of environmental damage is acid deposition, or acid rain as it is commonly known. These phenomenon occurs when emission of sulphur dioxide and oxides of nitrogen react in the atmosphere with water, oxygen and oxidants to form various acidic compounds. These compounds then fall to the earth in either dry form (such as gas and particles) or wet form (such as rain, snow or fog). More specifically, acid rain weaken trees by damaging their leaves, limiting the nutrients available to them, or exposing them to toxic substances slowly released from the soil. Acid rain that flows into streams, lakes and marshes also has serious ecological effects. In watersheds where soils do not have a buffering capacity, acid rain releases aluminium which is highly toxic to many species of aquatic organisms, from soils into lakes and streams.

Control measure

The primary natural processes of cleansing the environment are dispersion, gravitational settling, flocculation, absorption, rain-water etc. (Rasmussen *et al.* 1974). However, control of contaminants at their source level is a desirable and effective method through preventive or control technologies. Some measures that can be adopted in this direction are:

1. Using unleaded petrol
2. Turning off the light when not in use
3. Encouraging people to use public transport, walk or use a cycle
4. Petrol and diesel vehicles may be replaced by CNG fueled vehicle
5. No to plastic bags
6. Reduction of forest fires and smoking
7. Use of fan instead of air conditioner
8. Using clean energy resources if possible (wind, solar and geothermal energies reduce air pollution at a large level)
9. Industries and waste disposal sites should be situated outside

the city preferably on the downwind of the city and hazardous materials must be disposed safely

10. Catalytic converters should be used in industrial centres to help control emissions of CO and hydrocarbons. Emission rate should be restricted to permissible levels.
11. Mechanical devices such as scrubbers, electrostatic precipitator, filters, chimneys etc. in manufacturing process must be used.
12. The best way of reducing the ill effects of air pollution is tree planting
13. Industries and waste disposal sites should be situated outside the city preferably on the downwind of the city.
14. Catalytic converters should be used in industrial centres to help control emissions of carbon monoxide and hydrocarbons
15. Emission rates should be restricted to permissible levels by each and every industry.
16. The best way to reduce the ill effect of air pollution is tree planting
17. Continuous monitoring of the atmosphere for pollutants should be carried out to know the emission levels.

Biological method

A strong correlation between the intensity of air pollution and various forms of manifestations of different plant species growing near power plants and industrial establishment was noticed by Williams *et al.* (1996). Leaf injury symptoms in the form of chlorosis, necrosis and tip burn were found in the leaves of almost all the species. The particulate matters deposited on the leaves clog stomatal aperture thus affecting gas diffusion and energy conservation process in plants. Damages caused by the pollutants are reflected in the decrease of chlorophyll, carotenoides, ascorbic acid and protein and increase in sugar in comparison to control (where there is no pollution). These symptoms are simultaneously associated with increase in sulphate contents in leaves (Kashyap *et al.* 2001). Williams and Banerjee (1995) noticed a considerable reduction in chlorophyll, carotenoid, ascorbic acid and protein and an increase of sugar in the pollution affected (particularly SO_2) leaves of *Mangifera indica* and *Shorea robusta* growing near power plant. Nitrogen, phosphorus and potassium were also decreased considerably and sulphur content was increased in the polluted atmosphere (Table 3). About 80% of the chlorophyll was reduced in *M. indica* and 75% in *S. robusta.* Except in ascorbic acid, the reduction of other biochemical compounds was more in *M. indica*. Percent increase of sulphur was more (170) in *S. robusta* than that in *M. indica* (140). The percent reduction was slightly higher in chlorophyll "a" than in chlorophyll "b" indicating that chlorophyll "a" is more sensitive than chlorophyll "b". There was a considerable increase of sugar in both the plants. Accumulation of reducing sugars and depletion of starch was reported in *Mangifera indica* and *Psidium guajava* (Kumar and Singh, 1988).

In higher plants the assessment of foliar symptoms is probably the most widely used bioindication techniques. The presence or absence of foliar injury has

been used to establish zones of impact, while the type of foliar injury has been used to discriminate among various possible air pollutants. However, visible damage is not always specific to a particular pollutant or other environmental stress. In addition not all species have been exposed to all known pollutants to establish their symptom expression. Bio monitoring using plants can be a simple and inexpensive process, which lends itself as a potential, adaptable method of assessing air quality in developing countries. It becomes highly applicable in remote areas where continuous, direct air sampling is expensive and impractical. Thus, the injury symptoms and biochemical changes of plants due to pollution provide reliable information for detection, recognition and monitoring of air pollutants. Sensitive plants, for future plant biomonitoring programme, may be used as indicator plants after standardization of artificially gaseous pollutant induced biochemical changes. On the other hand, the resistant species may be recommended for any afforestation programme to combat the environmental pollution in the emission polluted areas.

The phytotoxicity of sulphur dioxide and its adverse effects on agricultural crops (Agarwal 2000) and forests (Innes and Haron 2001, Agarwal and Agarwal 2001) are well documented, which depends primarily on the level of the pollutants and the species composition (Emberson *et al.* 2001). Leaf injury symptoms in the form of chlorosis, necrosis and tip burn were found in the leaves. Subtle or invisible injury may also occur without chloratic or necrotic patches on the leaf surfaces, which eventually affects the growth and yield of plants due to physiological disorder. Emberson *et al.* (2001) observed yield reductions up to 50% in agricultural crops growing in the vicinity of thermal power plants where SO_2 concentration was in the range of 75 to 135ug m^{-3}.

Air pollution can be minimized by a variety of mechanisms. The primary natural processes of cleansing the environment are precipitation, chemical reaction, dry deposition (sedimentation) and absorption (Rasmussen *et al.,* 1974). However, the plant communities such as forests, tree plantations or green belts play very important role in mitigating atmospheric pollution by filtering and absorbing the pollutants.

Depending upon the extent of damage and per cent deviation of all the biochemical parameters, the plants growing near polluted industrial areas can be grouped into three categories, viz., highly tolerant, moderately tolerant and sensitive to emission.

Acacia nilotica, Aegle marmelos, Ailanthus excelsa, Azadirachta indica, Anacardium occidentale, Butea monosperma, Casuarina equisetifolia, Ficus bengalensis, Ficus religiosa, Peltophorum ferrugineum, Pongamia pinnata, Cassia siamea, Cassia fistula, Pithecellobium dulce, Syzigium cuminii, Ziziphus jujuba etc. are more resistant to emission. These trees may provide a natural sink for air pollutants/thermal power emissions and may be planted on large scale for green belt around industrial areas where SO_2 and SPM are the major pollutants. The leaf injury symptoms and biochemical changes of plants due to pollutants provide reliable information for detection, recognition and monitoring of air pollutants. Some species have shown specific resistance to the prevalent pollutant concentration and have not shown much deviation in the biochemical

parameters and some plants are highly sensitive. Sensitive plants, for future plant bio-monitoring programme, may be used as indicator plants after standardization of artificially gaseous pollutant induced biochemical changes. On the other hand, the resistant species may be recommended for any afforestation programme to combat the environmental pollution in the polluted areas.

Bhopal gas tragedy revealed that killing effect of MIC gas had no effect on tree species like *Bottle brush, Cassia siamea, Bargad, Peepal, Mango, Ashok* and *Jamun.* Similarly, planting of *Babool, Bel, Siris, Kathal, Neem, Kachhnar, Amaltas, Lasoda, Bargard, Peepal, Siver oak, Mango, Amla, Ashok, Jamun, Imli, Arjun* is encouraged near and around refineries. Near tanneries and factories releasing contaminated effluents, trees like *Babool, neem, Karanj, Peepal Arjun* has been found extremely helpful.

Bel, Maharukh, Siris, Chatian, Kadamba, Kathal, Neem, Bougainvillea, Palas, Semal, Madar, Amaltas, Cassia siamea, Jhau, Shisham, Tendu, Safeda, Bargad, Pakar, Peepal, Silver oak, Behaya, Ghaneri, Bakam, Amla, Jungle jalebi, Peltophorum, Karanj, Guava, Rain tree, Jamun, Imli, Arjun, Saja, Ber have been found to be effective in combating pollution created by Thermal Power Stations.

Among shrubs, herbs and grasses the following are pollutant tolerant.

Shrubs: *Argemone Mexicana, Croton bonplandianum, Calotropis procera, C. gigantia, Ipomea palmate, Zizyphus jujube, Z. nummularia, Solanum xanthocarpum, Crotalaria sericea* and *Datura metal*

Herbs: *Achyranthes aspera, Cassia tora, Cleame viscose, Croton spp., Euphorbia hirta, Echinops echinatus, Fimbristylis cypera, Indigofera linifolia, Pathenium hysterophorus, Phyllanthus simplex, Polygonum glabrum, Dicanthium annulatum, Desmodium triflorum* and *Blumea spp.*

Grasses: *Anthaxon ciliaris, Cynodon dactylon, Digitaria sanguinalis, Dicanthium annulatum, Eragrostis uniloides, E. tenella, E. ciliaris, Heteropogon anthephorides, Saccharum spontaneum, Setaria glauca* and *Sporobolus spp.*

With rapid industrialization and consequent deleterious impact on environment, values of environmental protection offered by trees/forests are becoming clear. It is realized that importance of trees with regard to carbon dioxide is not in its value of timber but it is the locking up of carbon in wood over long duration.

Trees play an important role in the maintenance and amelioration of environment. They not only improve the atmosphere through absorption of obnoxious gases and release oxygen, but also help in trapping dust particles and effluents in water discharge. It is, therefore possible to correlate the intensity of air pollution with various forms of manifestation of different plants growing in the vicinity of the polluted areas and on this basis; trees may be graded as pollution tolerant and pollution sensitive. Gupta *et al.* (1995) worked out a sensitivity index of 12 species growing in the vicinity of thermal power plant emission on the per cent damage, reduction of chlorophyll, protein, carotinoid, ascorbic acid, N and P contents in leaves by giving 100 points to the highest value of each parameter and finding total score of each species. The

twelve species have been graded and indexed according to tolerance as :

Ficus religiosa (304.9) > *Butea monosperma* (305.6) > *Azadirachta indica* (307.8) > *Ficus bengalensis* (326.6) > *Diospyros melanoxylon* (326.6) > *Shorea robusta* (329.7) > *Terminalia arjuna* (332.9) > *Syzygium cumini* (340.5) > *Terminalia tomentosa* (356.5) > *Pongamia pinnata* (358.0) > *Mangifera indica* (360.0) > *Madhuca indica* (371.8).

Trees function as sinks of air pollutants owing to the fact of large surface area of their leaves which may absorb pollutants through their numerous stomatal openings. They are the best dust collector and average dust collecting capacity ranges from 2.08 to 5.35 g/m^2 on the leaf surface. However, it depends on the nature of species as well as season. Dust collection efficiency of trees with simple leaves just after rainy season is 4.15 g/m^2 for *Ficus religiosa*, 4.09 g/m^2 for *Ficus ingectoria*, 4.05 g/m^2 for *Mangifera indica;* 4.50 g/m^2 for *Shorea robusta*, 3.59 g/m^2 for *Ficus bengalensis*, 5.35 g/m^2 for *Tectona grandis*, 4.49 g/m^2 for *Terminalia arjuna*; trees with compound leaves is 3.05 g/m^2 for *Butea monosperm*a, 2.92 g/m^2 for *A. Indica*, 2.24 g/m^2 for *Cassia fistula* and 2.08 g/m^2 for *Tamarindus indica* (Williams and Banerjee 1995). Patel and Tewari (1991) detected particulate and dust trapping capacity of tree species in the Raurkela industrial complex and the dust trapping capacity was in the order:

Psidium guajava > *Bassia latifolia* > *Syzygium cuminii*

Kashyap *et al.* (2001) assessed the effect of different plant species when the levels of suspended particulate matter (780 ug/m^3), SO_2 (99.9 ug/m^3) and NO_2 (39.5 ug/^{3}) was much prominent and much above the threshold limit particularly for SPM and SO_2 as suggested by (WHO). Leaf injury symptoms in the form of chlorosis, necrosis and tip burn were found in the leaves of all the species at 0.25km distance from power plant. (Table 3).

Thus the damage symptoms and biochemical changes of plants due to pollution provide reliable information for detection, recognition and monitoring of air pollutants. Sensitive plants, for future plant monitoring programme may be used as indicator plants after standardization of artificially gaseous pollutants induced biochemical changes. On the other hand, the resistant species may be recommended for any afforestation programme to combat the environmental pollution in the polluted areas (Banerjee 2008).

Table 3. Damage per cent, leaf wash pH and foliar dust deposition (g/m^2) of plant growing near Thermal Power Plant (Kashyap *et al.* 2001)

Plant	Damage (%)	Leaf wash pH		Dust deposition
		control	polluted	
Azadirachta indica	46	6.3	7.4	6.30
Aegle marmelos	44	7.5	7.7	6.03
Ficus bengalensis	38	6.5	7.2	18.86
Ficus religiosa	28	7.4	7.7	21.16
Madhuca indica	57	6.6	7.6	8.16
Pongamia pinnata	60	7.5	7.8	4.50

Syzygium cuminii	56	7.4	7.7	5.36
Terminalia arjuna	43	7.2	7.8	8.26
Terminalia tomentosa	48	7.2	7.6	8.10
CD (0.01)	**14.435**	**0.337**	**0.140**	**1.991**

Conclusion

Human activities have an adverse effect on the environment by polluting the water we drink, the air we breathe and the soils in which plants grow. With the increase of human population, the need for food is also expected in that proportion which has resulted in massive destruction of land due to increasing crop productivity particularly in the developing countries. Although the industrial revolution was a great success in terms of technology, society and the provision of multiple services, it also introduces the production of huge quantities of pollutants emitted into the air that are harmful to human health. The ever increasing pollution of the environment due to rapid industrialization, expansion of chemical industries and the need to generate cheap forms of energy has caused the continuous release of anthropogenic pollutants into natural ecosystems causing almost irreparable damage to environment and producing adverse effects on vegetation, animals, crops, soil and water. In fact, the pollution has assumed distressing dimensions for the present as well as future generations and has been one of the greatest concerns for science and the general public for the last fifty years.

There is a need to creating general awareness among masses regarding the hazardous effect of pollution around the world. Particularly in our country, the people generally lack consciousness of the ill effects which pollution creates and how the society including they themselves stand to beneficiary preventing generation and emission of pollutions. This awareness can be created through various media like newspapers, television, radio, flyers, seminars etc. The target area should be educational institutes and more particularly school. There is an urgent need for intense awareness on various environmental issues involving school and college students as well as club and NGOs so that the environment should be kept clean and green especially to the future generations.

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Critical endangered species *Bacopa monnierii* - Micro propagation technique for large scale production

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Introduction

Bacopa monnieri (L) Wets. (Scrophulariaceae) commonly known as Brahmi is well exploited in the traditional medicine (Roodenrys et al., 2002). the pharmacological importance of this plant is mainly due to the presence of different types of saponins e.g., bacoside A, B, C and D (Rastogi et.al, 1994) Traditional system of medicine as a memory enhancer, anti-inflammatory, analgesic, antipyretic, sedative and anti-epileptic agent effects of *Bacopa monnieri*. According to Sing and Sing (1998) Brahmi was used four weeks in 35 patient's treatments for Anxiety neurosis. In those patients receiving *Bacopa monnierii* anxiety levels were lower about 20%. In IndiaBrahmi is known as a different name in English thyme leaved Gratiola, in Sanskrit brahmi, nirbrahmi, Bengali-adhobirni, Malaya-marbama, Oria-Urishhuparinietc in The Ayurveda Materia Medica. *Bacopa monnierii* has been recognized for its brain enhancement characteristics of Brahmi, Brahmi is a small, creeping herb with numerous branches, Root are Tap, branched and appear from the nodes of the stem, leaves are small simple and alternate present in each node And blue, white, light purple flowers. In India it grows naturally in wet soil, shallow water and marshy areas on the banks of ponds, rivers, lakes and canals in the crop field. *Bacopa monnierii* is a vegetative propagated medicinal plant enlisted among the most endangered plant due to its overexploitation.in India it is rare plant so its cultivation is very important through the plant tissue culture technique. The leaves of *Bacopa monnierii* contains bacoside-A, bacoside-B important alkaloids (saponin) which are used in preparation of several drugs particularly brain tonic *Bacopa monnierii* has also been linked to phytoremediation programs for the removal of heavy metals such as cadmium chromium (Mehta et.al 2012).

Fig: *Bacopa monnierii* flower in different color

Chemical constituents

Bacopa monnierii contains a wide variety of medically active substances including Alkaloids, saponins, sterol stigma sterol, sapogenins, flavonoids, herpestatine etc. Alkaloids such as Brahmins, Herpestatine, and a mixture of three bases were reported from the leaves of this plant. Saponins: Saponin such as bacosides A, B, C, and D which are the active triterpenoid principles and known as "memory chemicals. Percentage of saponin varies according the geographical distribution.

S.No.	Name of chemical	Molecular Formula	Melting point
1.	Monnierin	$C_5H_{82}0_{21}.3H_20$	$116\text{-}17^0$
2.	Bacoside –A	$C_{41}H_{68}0_{13}.4H_20$	250^0
3.	Bacoside –B;	$C_{41}H_{68}0_{13}.5H_20$	203^0
4.	Herpestatine	$C_{34}H_{46}N_20_6$	$116\text{-}17^0$
5.	Aglycone	$C_{21}H_{20}0_8$	$235\text{-}37^0$

Material and method for micropropagation technique

Indian System of Medicine belonging to family scrophulariaceae and used traditionally for centuries as brain tonic to improve intellect and memory. Many

effective protocols for high frequency in vitro plant regeneration were developed by using leaf explants of *Bacopamonnierii*. The Murashige and Skoog medium (MS) supplemented with various concentrations of cytokinin and auxins were used for high frequency shoot regeneration were achieved by using leaf explants (C. SHANTI et.al 2008). Regenerated shoots were rooted on MS medium supplemented with IBA, IAA and NAA. Nearly 95% of the rooted plantlets were survived when transferred to nursery shade and subsequently to the field. *Bacopa monnierii* is very use full and important medicinal valuable plant for its chemical constitutes specially saponin (bacoside). Bacoside are used in the manufacture of medicinal drug for memory enhancer drug .so it is very necessary to identify the active ingredients present in it and concentration percent of active ingredients in particular location situated Brahmi plant.chemo profiling technique Such that's it's could be used for micropropagation for large commercially production of genetically identical species in large number. The aim of the present study was to develop high frequency multiple shoots and root regeneration of *Bacopa monnieri*. Their bacoside percent obtained utilizing the least number and various concentrations of PGRs. This protocol also offers the rapid shoot formation from the apical node for both purposes Auxin (IAA) and cytokine (kn., BAP) are used. Criteria for selection of explants depends on the species and type of culture the disease free, new germinate; phenotypically superior plant should be selected as an explant. The Better Time of explants collection early morning or evening.

The branches (about 2-3 cm) of shoots of *Bacopa monnieri* plants were collectedfrommedicinal garden (Sardar Patel University Dongariya, Balaghat).The branches with apical node explants were washed in running tap water for ½ hrs. to remove dust and pathogen and then washed again thoroughly by adding a few drops of 2% detergent EXTRAN for 5 minutes to remove the superficial dust particles and Treat the explants with 2% bovistin (antifungal agent) to for 10 minutes as well as fungal and bacterial spores. They were surface sterilized with 0.1% HgCl2 for 1 min followed by rinsing them five times with double distilled water inside the Laminar Air flow chamber. And trim both the ends and leaf part of explants. Then explant's is ready for inoculation vertically on MS medium fortified with specific concentrations of growth regulators (BAP and IAA) singly or in combination adding 30 g/l sucrose and 0.8% agar. The hormones used for experiment were taken from stock solutions, which were previously prepared and kept under cold condition in refrigerator (Doods and Roberts, 1985). After inoculation culture kept on the culture room. After 10 to 15 days', growth was observed.

In the present investigation plant tissue culture work is a commercially important. *Bacopa monnierii* is a rare and endangered plant species. So present study we have been tried to multiplication of shoot and root of *Bacopa monnierii* through plant tissue culture technique for production of large amount plantlet. In plant tissue culture of *Bacopa monnierii* multiplication forshoot and root we have used different concentration (IAA and BAP) of MS media. Auxin (IAA) is responsible for root growth and cytokine (BAP) are shoot

proliferation. IN this study wefound that in the *Bacopa monnierii* BAP and IAA plant growth regulator support the MS media for shoot and root we have used different concentration (IAA and BAP) of MS media. Auxin (IAA) are responsible for root growth and cytokine(BAP) are shoot proliferation.in this study we found that in the *Bacopa monnierii* BAP and IAA plant growth regulator support the MS media for multiplication shoot and root formation IAA(3mg/liter) and BAP (3.5mg/liter) are provide best result.

Medicinal uses of *Bacopa monnierii*

Bacopa monnierii is commonly known as Brahmi. Brahmi is a memory enhancer; it is used in brain tonic mentioned in Ayurveda. Brahmiis a multipurpose medicinal herb it is used for many disease treatment/cures. Recent time many researchers doing work in Brahmi plant for making memory enhancer tonic and tablets. CDRI Lucknow Scientists have developed a tablet which is derived from Brahmi. Brahmi mainly distributed in Himalayan region and wet and hilly forest. Its overexploitation is a main reason to list in endangered plant.

Some medicinal uses of Brahmi

Brahmi is a popular brain tonic. It is used to promote overall mental health while rejuvenating the optimal function of the brain. Brahmi is believed to provide the following health benefits.

- Improves mental cognition
- Improves the retention of memory
- Improves concentration
- Insanity cure
- Convulsions treatment
- Senility cure
- Prevents Epilepsy attacks
- Sedative effect that does not dull the senses,
- Alzheimer Disease treatment.

Brahmi is used to treat pain due to nerve problems**.** A paste made from Brahmi leaves and carrier oil are applied to the affected area to improve the symptoms. It is used to treat neuralgia and sciatica.

Brahmi in ayurvedic medicine

Brahmi has long history in Indian Ayurvedic medicine. It is widely used for its effect in blood circulation that promotes efficient function of the liver, lungs and the kidneys.

Brahmi is traditionally used to treat skin problems -including psoriasis, eczema, abscess and ulceration. Brahmi is used to stimulate skin cell regeneration and growth.

Brahmi stimulates kidney function

It promotes the efficient functioning by the kidneys.

Brahmi improves the body metabolism

It is believed to increase the triiodothyronine (T3) and thyroxine (T4) in blood. T3 and T4 help control your body's metabolism.

Brahmi has anti-inflammatory activity

Brahmi leaves are mixed with other oils and massaged directly to the affected area to alleviate pain and swelling. Brahmi is used for the treatment of rheumatism, arthritis, gout, and other body and muscle pains.

Brahmi is used to promote overall health

Brahmi leaves made into a decoction such as tea can rejuvenate not only the mind but the entire body. It combats stress and fatigue.

Brahmi has respiratory health benefits

Brahmi leaves decoction is also used to improve the symptoms associated to respiratory problems that may include cough, colds, bronchitis and asthma. It is also used as a poultice and applied over the chest to improve breathing.

Fever

The juice from the Brahmi plant is used to treat the symptoms of fever.

Brahmi is used for stomach problems

Brahmi tea is taken to treat constipation and flatulence. For younger children, the warm juice is applied over the stomach to relieve stomach pain.

Brahmi is used for hair and scalp care

Brahmi is applied to the scalp to promote hair growth and prevent hair fall land greying hair. It is used to treat baldness.

Leprosy

Indian medicinal system uses Brahmi to treat the symptoms of leprosy.

Brahmi Leaves for Elephantiasis

In Indian medicine, the paste made from Brahmi leaves is applied on the affected parts for half an hour twice a day.

Brahmi in Ayurvedic Medicine

Brahmi has long history in Indian ayurvedic medicine. It is widely used for its effect in blood circulation that promotes efficient function of the liver, lungs and the kidneys.

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Water pollution – Its control

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Introduction

Pollution is derived from Latin word "pollure" which means to defile. Pollution is a negative/undesirable change in the environment, usually the addition of something hazardous or detrimental. It is the man-induced change leading to deterioration of natural environment in quality. According to the environmental campaign organization (WWF), Pollution from toxic chemicals threatens life on this planet. Every ocean and every continent, from the tropics to the once-pristine polar regions, is contaminated. The introduction of pollutants, the elements of pollution causes harm or discomfort to the ecosystem including changes in the abundance of species interruption to energy and nutrient flows, modification of habitats, reduction of air, water and soil quality and changes in the stability and resilience of the ecosystem (Banerjee 2010).

Pollution is drastically rising in all the countries due to rise in human activity associated with modern technology and population growth. Development activities such as construction, transportation and manufacturing not only deplete the natural resources but also produce large amount of wastes that leads to pollution of air, water and soil, the three natural resources of the earth. The five elements of the life support system viz., air, water, land, flora and faunae are inter-related and inter-dependent and the entire process is self generating and auto-sustainable. As long as man, as a part of this system, worked in harmony with nature and used the resources for its normal sustenance, damage to the system was minimal. With the process of development, human activities assumed such enormous dimensions that the life support system could no longer sustain these. Accordingly, the waste generated through human activities was much more than the system could absorb or assimilate. This has resulted in the problem of pollution (Banerjee *et al.* 1998.). Pollution poses health hazards, endangers wild life and makes the ecosystems unsafe for future human survival.

A pollutant is a waste material that pollutes or damages the environment which can come in the form of chemical substances or energy such as noise, heat or light. It is a by-product of human activities which enters or becomes concentrated in the environment, where it may cause injury to humans or desirable species (Allaby 1994) and is one of the greatest problems that the world is facing today, increasing with every passing year and causing grave and irreparable damage to the earth. Three factors determine the severity of a pollutant: its chemical nature, the concentration and the persistence. Some pollutants are biodegradable and therefore will not persist in the environment in the long term.

Water pollution

Water on Earth moves continually through the water cycle of evaporation and transpiration (evapo-transpiration), condensation, precipitation, and runoff, usually reaching the sea. Evaporation and transpiration contribute to the precipitation over land. The water cycle (known scientifically as the hydrologic cycle) refers to the continuous exchange of water within the hydrosphere, between the atmosphere, soil water, surface water, groundwater and plants.

Water moves perpetually through each of these regions in the *water cycle* consisting of following transfer processes:

- Evaporation from oceans and other water bodies into the air and transpiration from land plants and animals into air.
- Precipitation, from water vapor condensing from the air and falling to earth or ocean.
- Runoff from the land usually reaching the sea.

Global patterns of weather and precipitation are dictated by the movement, quantity and temperature of water, both in the ocean and in the atmosphere. As water vapor circulates through the atmosphere and into the oceans, it alters the temperature and pressure, resulting in wind and currents. As ocean currents move from the equator north and south to the poles, the water cools. The distribution in ocean temperature directly affects regional climate patterns. Because plants and animals have specific environmental requirements, temperature and rainfall determine that species are able to survive in a given location..

Types and causes of water pollution

Water pollution is the contamination of water bodies (e.g. lakes, rivers, oceans and ground water) very often by human activities. This form of environmental degradation occurs when pollutants are directly or indirectly discharged into water bodies without adequate treatment to remove harmful compounds. Water pollution is the second most imperative environmental concern along with air pollution. Major causes of water pollution are the discharge of waste water from urban areas. Other important sources of pollution are the use of chemical fertilizers and pesticides in agriculture, accidental spillage of oil and industrial chemicals, disposal of sludge to rivers and disposal of solid wastes to land filling. These sources cause chemical pollution. Physical pollution of water sets in when stream water is heated by addition of hot water discharged from power stations and factories and also when inert solid debris is put into streams. When living things like human disease organisms of faecal origin or fish disease organisms are added to water, it gets biologically polluted. Algae are the autotrophic organisms which make a substantial contribution towards the primary productivity in aquatic ecosystems and occupy the base level in energy transfer within such natural ecosystems (Prasad and Singh 1980). Mishra and Tripathi (2000) reported that the discharge of sewage adversely affected algal community structure and phytoplankton productivity of river Ganga near Varanasi.

Municipal as well as industrial effluents contain different heavy metals toxic to the plants and animals. When these effluents are used to irrigate the land, these heavy metals are accumulated in soils by adsorption or precipitation phenomena and their concentrations in soils may be increased through the long-term land application. The crops growing on such

land absorb the heavy metals which ultimately enter into the food chain of animals and human beings. However, among the metals, Cr, Fe and Pb pose relatively little hazard to plants and animals as they are converted to a form of very low solubility and unavailability to plants and are mostly accumulated in the surface of the soil (Adhikari *et al.* 1993). Manganese may constitute a problem when added to acid soils as the increased level of soluble manganese may cause phyto-toxicity (Jones and Jarvis 1981). Kirkham (1975) reported that though the heavy metals constitute a small fraction of the sewage-sludge, nevertheless the heavy metal content of soil may be significantly raised through long term land application. The study performed by Bansal *et al.* (1992) in the soil of Jamalpur, Ludhiana, indicates that the continuous use of industrial wastewater for five years or more results in the accumulation of Zn, Cu, Mn and Fe in soil to levels that may cause imbalances of nutrients in the soil and plants and affect adversely the crop yield. Singh *et al.* (1991) also reported that the contents of heavy metals increased with increasing of irrigation with sewage water as well as refinery effluents. Maiti *et al.* (1992) observed that although sewage effluents are rich in nutrients, the continuous application of sewage effluents makes the soil alkaline and increases the salt content and heavy metals. Thus the buildup of heavy metals in soil profile may constitute hazard not only to plants but the consumers of harvested crops. In India, about 70 per cent of the available water is polluted and about 73 million work days are lost due to water pollution diseases. About 60 per cent of water pollution is caused by municipal sewage. In India most of the rivers at various stretches suffer from pollution because a large number of industries discharge their effluents into the river. Ash dumps from power plants, contain many polluting metals and complexes, which are carried by nearby water bodies and ground water. The major heavy metal contaminated sites in India are given in Table 4.

Table 4. Major heavy metal contaminated sites in India*

Chromium	Lead	Mercury	Arsenic	Copper
Ranipet Tamil Nadu	Ratlam Madhya Pradesh	Kodaikanal Tamil Nadu	Tuticorin Tamil Nadu	Tuticorin Tamil Nadu
Kanpur Uttar Pradesh	Bandalamottu mines, Andhra Pradesh	Ganjam Orissa	West Bengal	Singbhum mines Jharkhand
Vadodara Gujarat	Vadodara Gujarat	Singrauli Madhya Pradesh	Ballia and other districts of Uttar Pradesh	Malanjkhand Madhya Pradesh
Talcher Orissa	Korba Chhattisgarh			

*Source Gautam, S.P., Central Pollution Control Board, New Delhi

Water pollution causes approximately 14,000 deaths per day mostly due to contamination of drinking water by untreated sewage in developing countries.

An estimated 700 million Indians have no access to a proper toilet and 1000 Indian children die of diarrheal sickness every day (The Economist 2008). Water borne diseases occur when parasites or other disease causing microorganisms are transmitted via contaminated water, particularly water contaminated pathogens originating from excreta. These include typhoid, intestinal parasites and most of the enteric diarrheal diseases caused by bacteria, parasites and viruses. The most serious parasitic diseases are amoebiasis, giardiasis, ascariasis and hookworm. Table 5 shows the count of coliform bacteria in major Indian rivers. When the discharge of nutrients such as N, P and others such as pesticides etc. from agriculture, waste disposal, fossil fuel etc. reaches the coastal zone, it stimulates harmful overgrowth of algae which have direct toxic effects on aquatic animals and result in low-oxygen conditions. Polluted beach water can cause rashes, ear aches, pink eye, respiratory infections, hepatitis, encephalitis, gastroenteritis, diarrhea, vomiting and stomach aches.

Table 5. Toxicity of River water*

River	Faecal Coliform (Number/100ml)
Sabarmati	$2.8X10^6$
Yamuna	$1.7X10^6$
Ganga	$1.1X10^6$
Brahmputra	24000
Cauvery	28000
Brahmani	60000
Satluj	3500
Krishna	10000
Mahanadi	17000
Baitarni	11000
Godavari	3460

*Bhardwaj (2005)

Arsenic is a semi metal element in the periodic table. It can enter drinking water supplies from natural deposits of the earth or from agricultural or industrial practices.. Consumption of arsenic through drinking water can cause skin damage, circulatory system problems and on increased risk of lung and kidney cancers. Fluoride is a major naturally occurring contaminant in drinking water. Low levels might prove beneficial in preventing dental problems but its high levels can cause structural tooth damage and very high levels can cause skeletal damage. Metals like mercury, zinc, copper and cadmium usually enter the water supply as industrial wastes and their excessive concentrations can cause physiological damage to humans, including damage to the central nervous system. Mercury poses a huge threat to human health because once it enters the body the destruction that occurs is usually irreversible. Symptoms associated with mercury toxicity are tremors, ataxia, paresthesia, sensory disturbances, cardiovascular collapse, severe gastrointestinal damage and even death (Nehra and Trivedi 2008).

Most people's idea of water pollution involves things like sewage, toxic metals, or oil slicks, but pollution can be biological as well as chemical. In some parts of the world, alien species are a major problem. Alien species (sometimes known as invasive species) are animals or plants from one region that have been introduced into a different ecosystem where they do not belong. Outside their normal environment, they have no natural predators, so they rapidly run wild, crowding out the usual animals or plants that thrive there. Common examples of alien species include zebra mussels in the Great Lakes of the USA, which were carried there from Europe by ballast water (waste water flushed from ships). The

Mediterranean Sea has been invaded by a kind of alien algae called Caulerpa taxifolia. In the Black Sea, an alien jellyfish called Mnemiopsis leidyi reduced fish stocks by 90 percent after arriving in ballast water. In San Francisco Bay, Asian clams called Potamocorbula amurensis, also introduced by ballast water, have dramatically altered the ecosystem.

Urbanization pollutes water in the following ways:

1. As more and more people move into cities and towns a number of factors cause pollution of the physical disturbance of land for the construction of houses, industries, roads etc.
2. Chemical pollution from industries, mines etc. Mining by both opencast and underground method affects the environment of the area. In the process of mining, huge amounts of water are discharged on surface to facilitate the mining operation. The discharged water often contain high load of TSS, TDS, hardness and heavy metals (Fe, Cu, Mn, Ni, Pb, Cd etc) which contaminate surface and ground water. Sometimes, it is acidic in nature and pollutes the water regime.
3. Inadequate sewage collection and treatment
4. Increase in fertilizers to grow more food which ultimately causes eutrophication. Eutrophication is an increase in the contamination of chemical nutrients in an ecosystem. Depending on the degree of eutrophication, subsequent negative environmental effect such as anoxia (oxygen depletion) and severe reduction in water quality may occur, affecting fish and other aquatic animal populations.

Thermal pollution is the rise or fall in the temperature of a natural body of water caused by human influence. Thermal pollution, unlike chemical pollution, results in a change in the physical properties of water. A common cause of thermal pollution is the use of water as a coolant by power plants and industrial manufacturers. Elevated water temperatures decrease oxygen level which can kill fish and other food chain composition, reduce species diversity and foster invasion by new thermophillic species (Laws 2000).

Control measure

The usefulness of the maximum water supply available to man is determined in large part by its quality. The quality of ground water is a direct function of the quality of its source. Thus great care should be taken to insure that ground water storage capacity is not irreparably harmed by the disposal of waste material. A number of different strategies are employed in order to deal with water pollution and restore water to a usable condition. In general, there are two different types of water remediation. The first one is known as in-situ purification. This approach involves using various methods to clean up the water supply where it is situated, rather than transporting the water to a filtering facility at another location. The second approach is known as ex-situ water remediation. With this approach, the water is collected and physically transported to a location where the contaminants can be removed

safely. With both these approaches, a number of different methods may be used to restore the water to a usable state. Thermal methods involve elevating the temperature of the water until dangerous bacteria are killed. Filtering the water with natural elements or a combination of chemicals is also an effective method of removing contaminants. Municipalities play an important role in the water pollution because all the wastes from the cities and residential areas are directly thrown into river. A Government should take strict steps in order to dump waste as a major water pollution solution. Toxic and hazardous liquid material from industries should be well treated in the treatment plants before dumping in the river or ocean. Municipalities should improve sewage treatment system to stop leaks in the pipe.

The preservation of natural wetlands provides a relatively simple water pollution solution. Wetlands serve as nature's filter and create a natural buffering zone between water and the land. The vast amount of various plant lives, naturally occurring bacteria and algae and microorganisms help to filter destructive pollutants. Discouraging wetland development and encouraging wetland replanting is one way that everyone can get involved in finding solutions to water pollution.

Additional water pollution solutions involve reducing nutrient and pesticide pollution by encouraging smatter agricultural practices and using biodynamic farming, no-till planting and settling ponds to reduce the amount of runoff that enters into the groundwater and flows into the streams. Another way that may be very effective would be to reduce household runoff of pesticides and fertilizers by using less of these chemicals or stopping their use altogether. Poultry waste and other animal wastes related to agriculture are disposed of in the nearby stream of water. Even farmers disposed pesticides and fertilizers in the river and fresh water streams. Water pollution solution in case of the agricultural pollutants can be easily reached with some strong steps. In case of agricultural pollutants mass propaganda about the proper disposal of waste should be conducted.

Sustainable management of water

Conjunctive use of surface and groundwater should be encouraged to shorten the water use and to alleviate the degradation of water and soil resources. Various technologies for groundwater recharge such as use of dug-wells, ponds, water harvesting structures in drains and rivers should be studied for feasibility.Vegetation management is more effective in areas having an annual rainfall of more than 280 mm.

Arid zones are beset with water shortage caused by low annual rainfall. The problem is often overcome by the introduction of irrigation, provided surface or ground water is available. An efficient drainage system is necessary to maintain a favourable salt balance for crop growth. Broadly, miro catchment water harvesting and run-off farming water harvesting are the main run-off collection methods. The aim of micro catchment water harvesting strategy is to store sufficient runoff water during the rainy season so as to meet the water requirements of crop growing. Other method is to collect the rain water in small digs and then recycling it.

Appropriate water conservation strategies, such as rainwater conservation by terracing slopes and different means of

water storage, including underground storage will differ according to the characteristics of the region and are particularly important in arid areas.

Other potential measures include improvements in irrigation management, such as lining canals and using high-efficiency irrigation systems to prevent land degradation through salinization and water-logging. Using treated waste-water for irrigation increases the fresh water available for other uses, including the maintenance of healthy aquatic ecosystems. Decreased use of fertilizers in agriculture can reduce the need for expensive treatment of water from nearby water bodies to make it suitable for human use.

One of the simplest strategies to improve both water supply management and water quality is the protection of watersheds through maintenance of naturally vegetated buffer strips along streams, river channels and around lakes.

Watershed management must be considered as a process of participatory planning, implementing, monitoring and evaluating a course of action involving natural, human and other resources. An holistic soil conservation and watershed management approach should consider those physical, socio-economic and institutional linkages that exist between upstream and downstream of a river basin or watershed.

It is an important element of watershed protection. The resulting gains in water quality and natural water storage can reduce the need for, and therefore, the costs of water-treatment and storage downstream.

Installing an effluent treatment plant is the first step to control industrial pollution. The effluents are treated according to various standards such as river standards, inland water-bodies and sewer standards, depending on where the treated water has to be drained.

Community involvement in the construction, operation, maintenance and funding of water systems should strengthen village institutions. On the other hand, women's organisations must organise awareness programmes which will enable the women to realise the scarcity of water and consequently take steps to conserve it.

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मध्यप्रदेश में वनवर्धन पद्धति के कार्य अभ्यास

प्रदीप कुमार कोरी एवं एम. राजकुमार

वन पारिस्थितिकी एंव जलवायु परिवर्तन प्रभाग

उष्णकटिबंधीय वन अनुसंधान संस्थान

(भारतीय वानिकी अनुसन्धान एवं शिक्षा परिषद्, पर्यावरण, वन एवं जलवायु परिवर्तन मंत्रालय, भारत सरकार)

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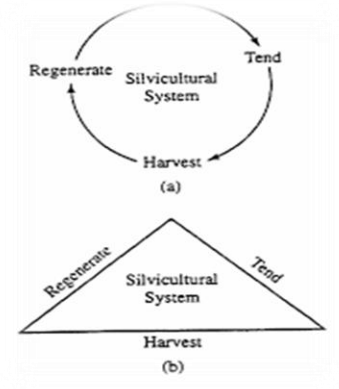
वन वर्धन वानिकी या वन विज्ञान की वह शाखा है जिसमें वनो के वृक्षो का पुनरुत्पादन, विकास स्थापन एवं परिपालन का विवेचन करती है । वनवर्धन का मुख्य उदेश्य यह है कि जंगलो में विभिन्न वृक्ष प्रजातियों का निरंतर उत्पादन करना होता है । भारतीय वन एवं वन उत्पादन शब्दावली के अनुसार वनवर्धन के 3 चरण हैं

1. पुनर्जनन
2. रखरखाव
3. जंगल की कटाई



वनवर्धन की प्रक्रिया में वांछित परिणाम प्राप्त करने के लिए पेड़ों का प्रबंधन विज्ञान का उपयोग कर पौधो को बढ़ावा देना उनका विकास करना प्रतिष्ठान, संरचना की गुणवत्ता एवं जंगलो के स्वास्थ को नियंत्रित करने का कार्य किया जाता है

वनवर्धन अभ्यासों में नर्सरी का विकास जमीन की बनावट मृदा एंव पानी का संरक्षण निहित है। वनवर्धन तंत्र पुनर्जनन प्रक्रिया के आधार पर मुख्यतः दो चरणो में वर्गीकृत किया गया है ।

1. उच्च वन प्रणाली (High forest system)
2. कोपिस तंत्र (Coppice system)

उच्च वन प्रणाली

इस उच्च वन प्रणाली तंत्र में बीजो से पौधों के उदगम का स्त्रोत या तो प्राकृतिक होता है या कृत्रिम वृक्षारोपण द्वारा होता है । जहा आमतौर पर नियमित आवर्तन लम्बे होते हैं । ऊंचे जंगल में पेड़ एक या कई प्रजातियों के हो सकते हैं । इसे दो वर्गो में बांटा गया है

निःशेष पातन पद्धति से बीज द्वारा प्राकृतिक पुनर्जनन

निःशेष पातन पद्धति में प्रौढ वन या उसका एक भाग पूर्णतः काट दिया जाता है ऐसी दशा में प्राकृतिक पुनर्जनन की आशा कटे हुए क्षेत्र में पडे सुषुप्त बीजों से कटने से पूर्व वृक्षो में उपस्थित अग्रिम पुनर्जनन से की जाती है ।अग्रिम पुनर्जनन ओवरवुड को प्रजातियो के उन विजौलो, वाल वृक्षो तथा वृक्ष केा को कहते हैं जो पुनर्जनन प्रारंभ करने से पूर्व प्राकृतिक रुप से किसी वन में विस्थापित हो जाते हैं ।

यह सिस्टम मुख्यतः मध्यप्रदेश, उत्तरप्रदेश, तमिलनाडू, पश्चिम बंगाल एंव ओडिसा राज्यो में प्रयोग किया जाता है। यह प्रक्रिया उच्च वन प्रणाली में सबसे सरल हैं। इस प्रक्रिया में बहुत ज्यादा कार्य कुशलता और देख रेख की अवश्यकता नहीं पडती और उपज भी प्रति हेक्टेयर ज्यादा होती हैं एवं कटाई, निष्कर्षण भी कम लागत में होता हैं ।

पुनर्जनन चरणः-

1. निःशेष पातन के लिए वार्षिक कूप का सीमांकन निर्धारण ।
2. बढते भण्डार के लिए जगह तैयार करना ।
3. पूर्ण रुप से कटाई और कटे हुए अवशिष्ट को जलाना कटाई की गई जगह में निरिक्षण करना एवं मृदा के लिए उपयुक्त उपाय करना ।

फिर विभाग वृक्षारोपण पुस्तिका प्लांटेशन जनरल तैयार करेगा जिसमे जगह, पौधों के बीच दूरिया, प्रजातियो का नाम उनकी सख्या और अन्य वनवर्धन एंव वृक्षारोपण सम्बंधी सारी जानकारी निहित होंगी ।

रक्षि वितान (Shelter wood system) पद्धतियो में बीज से पुनर्जनन

इस पद्धति में पुनर्जनन के वृक्षो को छाया में प्राप्त किया जाता है प्रोढ उपज एक ही बार में ना गिराकर कई बार गिराई जाती है और अंतिम पातन उस समय किया जाता है जब पुनर्जनन अच्छी तरह से स्थापित हो जाता हैं । और प्रतिकूल कारको से उसकी रक्षा करने की अवश्यकता नहीं होती रक्षि वितान पद्धिति को कई भागो में वर्गीकृत किया गया है जिसमे यूनिफार्म, समूह, अनियमित पट्टी प्रणाली शामिल है इस पद्धति में जंगलो की प्रजातियो को काटकर एक विशेष प्रजाति के अंकुरण को स्थापित किया जाता हैं ।

कोपिस तंत्र

इस वन प्रणाली तंत्र में भूमि के समीप से काटे गये काष्ठीय पादप के आधार पर आस्थनिक कालिका से प्रारोह फूटने लगता हैं इसे स्थूल कटाई प्रणाली भी कहते है स्थूल कटाई प्रणाली से

तात्पर्य इस प्रणालीमें नई फसल स्थूल कटाई के बाद उत्पन्न होती है इस प्रक्रिया में कटाई में आवर्तन कम होते हैं । कटाई प्रणाली भी तीन भागों में बांटी गई है-

1. सरल कटाई प्रणाली
2. दो बार कटाई प्रणाली
3. रक्षि वितान कटाई प्रणाली

आयु के आधार पर वनो का वर्गीकरण

समायु या नियमित वन (Even-aged managed forest)

इस प्रकार के वनो में प्राय: एक समान आयु के वृक्षो वाले वन खंड के लिऐ प्रयुक्त किया जा सकता है । यदि 100 या अधिक वर्षो वाले वृक्षो की कटाई नही कि गई तो वह वनखंड के आवर्तन आयु में 25 प्रतिशत तक अंतर की अनुमति दी जाती है ।

विषम आयु या अनियमित वन (Uneven-aged managed forest)

ऐसे वनो में प्राय: उन सस्यों के लिऐ प्रयुक्त किये जाते है जिनमे अलग अलग तनो की आयु में बहुत बड़ा अंतर होता है जहा तक कि यह अंतर सामान्यतया 20 वर्ग से भी अधिक होता है दीर्घ आवर्तन सस्यों के मामले में आवर्तन के 25

प्रतिशत से अधिक होता है । यह प्रवरण वन

कहलाता है ।

रचना के आधार पर वनो का वर्गीकरण

शुद्ध वन (Pure forest)

इस प्रकार के वन में कम से कम 80 प्रतिशत वृक्ष एक ही प्रजाति के होते है अन्य प्रजातिया बहुत कम या ना के बराबर होती है ।

मिश्रित वन (Mixed forest)

वह वन जिसमें दो या दो से अधिक प्रमुख किस्मों प्रजातियों के वृक्ष पाये जाते हैं। इन वनो में कम से कम 20 प्रतिशत छोटी प्रजातियों के वृक्ष भी पाये जाते हैं।

वनवर्धन के अध्ययन की आवश्यकता

वन उतने ही पुराने है जितना की यह विश्व। वन आदिमानव के समय भी थे और अब भी है इससे स्पष्ट है कि वे स्वयं पैदा होते है और बढ़ते भी है वनो का वैज्ञानिक प्रबंधन तो एक आर्वाचीन घटना है। और वह भी सभी स्थानो तक अभी नही पहुचाया जा सका आज भी इस देश में कई स्थानो पर असतत वन (Virgin forest) है। वनवर्धन का अध्ययन हमें इस कार्य में निम्नलिखित रुप में सहायक है-

आथिक दृष्टि से मूल्यवान प्रजातियो का उत्पादन

अक्षत वनो में अधिकांश प्रजाति या ना तो उपयोगी होती है और न मूल्यवान इस कारण ऐसे वनो में आर्थिक दृष्टि से मूल्यवान प्रजातियो का उत्पादन प्रति हेक्टेयर बहुत कम होता है। वनवर्धन आर्थिक दृष्टि से महत्वपूर्ण तथा अन्य दृष्टि से वाछित प्रजातियो के वन बनाने में सहायता करता है।

गुणवत्ता प्रकाष्ठ का उत्पादन

अक्षत वन या ऐसे वनो में जिसके वनवर्धन के ज्ञान के आधार पर परिपालन नही किया गया है प्रतिकूल कारको के कारण अनेक वृक्ष टेढ़े- मेढ़े, रोगी तथा सदोष प्रकाष्ठ वाले होते है फलस्वरुप गुणवत्ता प्रकाष्ठ का उत्पादन बहुत कम होता हैं अतः यदि गुणवत्ता प्रकाष्ठ का उत्पादन सुनिश्चित करना हो तो वनवर्धन का ज्ञान नितान्त आवश्यक है जिससे स्वस्थ्य एवं अपेक्षित गुण वाले वृक्ष पैदा किये जा सके।

प्रति हेक्टेयर अधिक प्रकाष्ठ आयतन का उत्पादन

वन संवर्धन के ज्ञान के अभाव के कारण वनो का विकास अनियमित होता है कहीं वृक्ष बहुत घने तो कहीं बहुत विरल होते हैं अधिक घने होने के कारण वृक्ष रोगी, टेढ़े-मेढ़े होते हैं जिससे गुणवत्ता प्रकाष्ठ का उत्पादन बहुत कम होता है विरले वनो में भूमि का पूरा उपयोग नही हो पाता जिससे इसके आयतन में कमी होती है अतः वनवर्धन के ज्ञान के आधार पर वन सास्यों को बनाना चाहिए।

आर्वतन में कमी

वन वर्धन के ज्ञान के अभाव में वृक्षो को वृद्धि के लिए ना तो पूरा प्रकाश मिलता है और ना ही भोजन फलस्वरुप उसकी वृद्धि पर प्रतिकूल प्रभाव पड़ता है और वृक्षो को (exploitable diameter) प्राप्त करने में अधिक समय लगता है। इससे प्रकाष्ठ का उत्पादन का व्यय बढ़ जाता है वनवर्धन के ज्ञान के आधार पर श्रेष्ठ वृक्षो को आयु के अनुरुप समुचित स्थान देकर उसकी वृद्धि गति को अधिकता एवं उसके आर्वतन को न्यूनतम किया जा सकता है।

रिक्त तथा वन विहिन स्थानो पर वन लगाना

प्राकृतिक वनो में अनेक छोटे बड़े क्षेत्र ऐसे होते है जहां किसी प्रतिकूल कारको के कारण वृक्ष नहीं होते ऐसे क्षेत्रो में वृक्षो को उगाने के लिए वनवर्धन का ज्ञान आवश्यक है।

प्राकृतिक वनो के स्थान पर मानव निर्मित वनो का निर्माण

कभी कभी प्राकृतिक वनो की प्रजातिया प्राकृतिक दशा में अपने आपको पुनत्पादित नही कर पाती या उनका पुनरूत्पादन बहुत ही मंद या अनिश्चित होता है यही नही कभी कभी स्थानीय प्रजातिया उद्योगिक दृष्टि से अनुपयुक्त होती है ऐसी दशा में मानव निर्मित वन चाहे वह देशज हो या परस्थानिक प्रजातियो के बनाने के अलावा कोई विकल्प नहीं होता।

भारत में वनसंवर्धन के अभ्यासों में सामुदायिक वन प्रबंधन प्रणाली का पालन किया जाता है। सामुदायिक प्रबंधन प्रणाली के अलावा पारम्परिक वन प्रणाली का भी अभ्यास किया जाता है।

मध्यप्रदेश में वनव र्धन पद्धति के कार्यो पर शोध

उष्णकटिबंधीय वन अनुसंधान संस्थान जबलपुर में चल रही परियोजना के तहत वनवर्धन अभ्यास के लिए तीन प्रकार के वनो का चयन किया गया है जिसमें साल, सागौन एवं मिश्रित प्रजाति के वन शामिल है इन वनो में उन कक्षो का चुनाव किया गया जहा पर कूप कटने हेतु पेड़ों को चिन्हित किया है। तीनो प्रकार के वनो के कक्षो में 0.1 हे. के 10-10 स्थाई सेम्पल प्लाट डाला गया एंव सभी स्थाई सेम्पल प्लाट का GPS किया गया। प्रत्येक 0.1 हे. के प्लॉट में वृक्ष प्रजाति की गणना एवं उनकी छाती गोलाई का मापन किया। इसके अलाबा प्लॉट में 2 X 2 के 24 (Quadrate) डालें जिसमें पुनर्जनन एवं घास प्रजाति की गणना कि गई एवं उसका डाटा रिकार्ड किया गया। इसके अलाबा तीनो वनो के कक्ष के प्लॉट से वहा का तापमान एवं आद्रता रिकार्ड करना तथा मृदा के नमूने संग्रहित कर प्रयोगशाला में परीक्षण हेतु उपलब्ध कराना।

कूप कटने के बाद उसी स्थाई प्लॉट में पुनर्जनन के अध्ययन हेतु 2×2 मी.के 8 quadrate डालें सभी quadrate के अंदर सिर्फ वृक्ष प्रजाति के पुनर्जनन जिनकी उचाई 30 से. मी. से अधिक है उसकी उंचाई एवं गोलाई का मापन किया एवं डाटा रिकार्ड किया एवं सभी पौधो में tagging किया गया। यह मापन कार्य सालमें 2 बार, बारिस के पहले एवं बारिस के बाद, 04 साल तक नोट किया जाना है। इसके अलावा तीन वनो में एक-एक control प्लॉट डाला गया जहां पर किसी भी प्रकार की कूप कटिंग और मनुष्यो द्वारा वहां नुकसान ना किया जाए। इसमें कूप कटिंग होने वाले कक्ष को लेने का उद्देश्य यह है कि कूप कटिंग के बाद पुनर्जनन की स्थिति देखना। यह देखना की पुनर्जनन कितनी तेजी से विकास कर रहा है क्योकि जो सघन वन है जिनका छत्र फैला होता है वहां पर उगने वाले छोटे पौधे (Seedlings) ज्यादा विकास नही कर पाते क्योकि वहा बहुत कम या ना के बराबर सूर्य का प्रकाश मिल पाता है जिससे उनका विकास बहुत धीमी गति से होता है या कुछ समय बाद वे पौधे मर जाते है।

कूप कटिंग के बाद उनका छत्र खुल जाता है जिससे सूर्य का प्रकाश सीधे पौधे को मिलने

लगता है पौधो को पर्याप्त प्रकाश मिलने से उनकी वृद्धि (उंचाई एवं गोलाई) में तेजी से विकास होने लगता है इसके साथ- साथ दूसरी प्रजाति या शाक, झाडी, लताऐं भी तेजी से विकास करने लगती है । इसमें सभी वनो साल, सागोन एवं मिश्रित वनो में पुनर्जनन की वृद्धि एंव विकास अलग –अलग गति से पाया गया ।

Khamer defoliator, *Calopepla leayana* and its control measures

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Abstract

This article deals with the pest profile of *Calopepla leayana* (Latreile) (Coleoptera: Chrysomelidae), a major defoliator of khamer, *Gmelina arborea* Roxb. (family Lamiaceae) in plantation. The management aspects of this insect pest are mentioned.

Key words: Khamer, *Gmelina arborea*, defoliator, *Calopepla leayana*, control measures

Introduction

Gmelina arborea Roxb. (family Lamiaceae) is commonly known as khamer or gamhar. This species is indigenous to Asia and occurs in India, Bangladesh, Pakistan, Myanmar, Sri Lanka, Thailand, Laos, Cambodia, Vietnam, and the Yunnan and Guangxi provinces of China (CABI, 2005). *G. arborea* occurs mostly in deciduous and moist–deciduous forests, but sometimes also in evergreen forests, and usually below 1200 m latitude. It is a fairly fast growing tree which produces a lightweight, creamy-white timber suitable for construction and carving, as well as for production of good quality pulp. It is often grown on short rotations of 15–20 years. It is a pioneering species and prefers full sunlight, although it can withstand partial shade (CABI, 2005). In Asia, *G. arborea* plantations have been raised within its natural distribution range and outside in India, Peninsular and East Malaysia, the Philippines and Indonesia. It has also been introduced into many countries worldwide. Large-scale plantations exist in some countries in Africa such as Nigeria, Sierra Leone and Malawi as well as in Brazil in Latin America (CABI, 2005). Some of the available planted area figures for the year 1990 are: Nigeria 91 000 ha; Sierra Leone 4000 ha; Bangladesh 6000 ha and Malaysia 11 000 ha (Pandey, 1995). In 1999, India had about 148 000 ha under *G. arborea* plantations (FSI, 2000), the largest for the species, and Indonesia had about 48 000 ha (Cossalter and Nair, 2000).

Overview of insect pests

Around 101 species of insects have been recorded in native plantations of *G. arborea* in India (Beeson, 1941; Browne, 1968; Mathew, 1986). Most of them are casual or occasional feeders, but some are serious pests. The most important insect species is the chrysomelid beetle, *Calopepla leayana* (Latreile) (Coleoptera : Chrysomelidae). Defoliation caused by this insect has become a constraint to expansion of plantations, particularly in northeast India (Beeson, 1941). Largely due to this pest, *G. arborea* has been dropped from the planting list by forest departments in many countries where the tree is indigenous (Nair, 2007).

Pest profile

***Calopepla leayana* (Latreille)**

(Coleoptera: Chrysomelidae)

Calopepla leayana (syn. *Craspedonta leayana*), commonly known as khamer

defoliator, has been recognized since the 1920s as a serious pest of *G. arborea* in northern India. The beetle of this insect are oblong 12–16 mm long and has a brilliant metallic colouration, with coarsely wrinkled, bluish green to violet blue elytra and pale yellow to reddish brown pronotum and legs. The larva has a characteristic appearance, with lateral spines. The excrement, instead of being ejected is extruded in fine, black filaments, longer than the body, and formed into bunches attached to the anal end. The moulted exuviae are also carried attached to the last abdominal segment. When disturbed, the larva flicks the anal filaments up and down and assumes a defensive posture. Under favourable temperatures, the life cycle is completed in 35–50 days, but third generation adults enter hibernation in winter. The biology of *C. leayana* has been studied in detail by Garthwaite (1939) and Ahmad and Sen-Sarma (1990). Infestation period is June-October.

There are no records of other hosts for *C. leayana*. The insect has been recorded in India, Bangladesh, Myanmar and Thailand. In India, it is prevalent in the northern region but also occurs in central and southern regions (Meshram et al., 2001; Nair and Mathew, 1988).

The defoliator appears to be most important insect pest of *G. arborea* in plantations within the natural range of the tree. It is perhaps the most widely reported and studied defoliator of *G. arborea* in Asia including India. Young larvae feed mainly on the undersurface of khamer leaves, leaving only the mid-ribs and main veins intact. The adult beetle feeds on the leaf, cutting large circular holes, and also eats young buds and shoots. Heavy infestation leads to drying up of shoots of young trees and the trees remain leafless for about four months of the growing season leading to ultimate death. *C. leayana* was reported for the first time on *Gmelina* in Meghalaya during the year 1995, indicating an apparent expansion of its range to the northeast of India (Wingfield and Robison, 2004). It is considered a serious pest of khamer plantations in Assam.

Control measures

Trapping of adults in hibernation shelters, hand-picking of beetles returning to the plantation after over-wintering and mixed cropping (instead of monoculture) have been suggested in the past (Beeson, 1941). The beetles can be attracted to white piece of cloth, then can be collected and killed mechanically. Insecticides, a commercial preparation of *Bacillus thuringiensis* subsp. *kurstaki* and the fungus, *Beauveria bassiana* have been shown to be effective against the larvae (Gupta et al., 1989; Sankaran et al., 1989; Sharma et al., 2001). According to Senthilkumar and Murgassen (2015), spraying of neem seed kernar extract like Neemazal at 5% (5ml/liter) or neem oil at 2 % (2ml/liter) sticking agent (Khadi bar soap at 3gm/lite of suspension) thrice at 15 days interval can be used to check the damage. Foliar spraying of 0.05% Chlorpyriphos, or 0.04% Monocrotophos or 0.05% Malathion is shown to be effective against all larval instars and beetles (Joshi and Jamaluddin, 2007).

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Environmental impact of melting glaciers

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Glaciers act as reservoirs of water that persist through summer. Continual melt from glaciers contributes water to the ecosystem throughout dry months, creating perennial stream habitat and a water source for plants and animals. The cold runoff from glaciers also affects downstream water temperatures. Many aquatic species in mountainous environments require cold water temperatures to survive. Some aquatic insects--fundamental components of the food web--are especially sensitive to stream temperature and cannot survive without the cooling effects of glacial melt water. Such changes in stream habitat may also adversely impact native trout and other keystone salmon species.

A glacier is a big chunk of ice that is created from falling and accumulated snow over a period of time. They get created in areas where the temperatures are exceedingly low; these include areas that are at sea level and mostly in high altitude areas like the mountain tops. Due to heat changes, especially to relatively high temperatures, the Glacier melting occurs – a process where the ice changes from solid to liquid or water.

In the recent past, scientists have discovered an alarming rate of glacier melting. And even though glaciers are reported to be the source of the fresh water available in the world, the concern is the current rate at which the melting ice is pouring into the sea. This intense melting of glaciers is producing a big ripple effect like extreme flooding and biodiversity loss, and scientists have warned that the world is losing its ice fast.

The burning of fossil fuels has resulted in the buildup of greenhouse gases in the environment thus influencing the warming trend because they trap heat in the atmosphere. The increase in temperatures is causing more and more glaciers to melt, consequently, this ends up exposing the earth underneath. The glaciers are capable of absorbing about 20% of heat from the sun, reflecting back the remaining 80%. So exposing the earth, changes this, because now the earth absorbs most of the heat and reflects a lesser percentage. This is a vicious cycle which has already affected most parts of the planet and will be quite problematic to stop if solutions are not put in place in the shortest time possible.

The glaciers in the Garhwal Himalaya in India are receding at a rapid rate that it is believed that they will be practically gone by 2035. A lot of places all over the world depend exclusively on the constantly flowing water from glaciers that are melting in producing electricity. Reducing or stopping the flowing of water will mean

stopping the production of electricity. The modern world cannot do without electricity, in which case people will resort to other forms of producing electricity, some of which will end up polluting the environment and further increase global warming.

There are areas that have ice glaciers on higher altitudes, and they are all thawing quickly, the melting is causing an abrupt rise in water input to other water bodies such as the rivers, lakes, and seas. The excess water may lead to the creation of new lakes that will continue growing in size.

These happenings are very alarming because the water bodies could be very large in volume. The result is overflowing, which will be a major disaster as they will destroy everything on its way, and making thousands of people homeless like the case in Bangladesh.

There are a lot of living organisms that rely mainly on glaciers for continued existence. Some animals require the cool temperatures for their day to day activities like the blue bear. Certain birds also rely on fish that are found in freshly melting glaciers. With the increasing water temperatures and water levels, this will start affecting aquatic plants. In consequence, the fish species will reduce and so will be the survival of the birds and animals that are dependent and adapted to the glacier habitats.

Coral reefs need sunlight for the process of photosynthesis, enabling their survival. When water levels increase due to glacier melting, sufficient sunlight will not be able to reach the corals. This will weaken their quality, and probably end up killing them in the long run. There are fish species that depend on the corals for food, without the coral reefs, they will also die. Additionally, individuals who rely on fish for food in such areas will be affected.

A lot of individuals may not be familiar with DDT and a lot of other such pesticides because they were banned all over the globe years ago. Research says that a lot of such chemical pollutants and pesticides became airborne and finally got deposited in the chilly places that contain glaciers, and for some time, the harmful chemicals stayed trapped in the layers. The rapid melting of glaciers is now discharging the chemicals back into the surroundings and water bodies.

The consequences of ice glaciers melting have not only been restricted to one part of the world, but to the whole globe. Each continent is experiencing the adverse effects of quickly melting ice glaciers such as flooding and other glacier-related disasters, which require huge intervention financial capital to mitigate. The worst part is that it is not possible to stop the fast melting of the glaciers due to the escalating rate of global warming.

Agricultural plants that mainly depend on the rain will most likely not get affected by the melting glaciers. Nevertheless, such places are few and do not contribute to the major portion of agricultural lands. In the dry periods, fresh water from glaciers will be in short supply, causing drying of the land which is not suitable for farming. The consequence will be a reduction in overall agricultural production.

Studies show that only 2% of the water available is fresh water that people can

consume. Over 70% consists of glaciers and snow. Water that has melted gets renewed by turning into ice through cooling to form glaciers. In lots of areas in the universe, it is the main source of fresh. However, with the increase in population and reducing the mass of glaciers, there will be a serious scarcity of fresh water in the coming years.

Glaciers play a significant role in reflecting and absorbing the heat on earth. This means that as glaciers keep on melting, temperatures all over the world will at the same rate keep on increasing. In some places, small ice glaciers have already disappeared, exposing the earth. The earth is not able to deflect as much heat as glaciers can thus heat will keep on increasing, more glaciers continue melting and water levels keep on increasing.

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