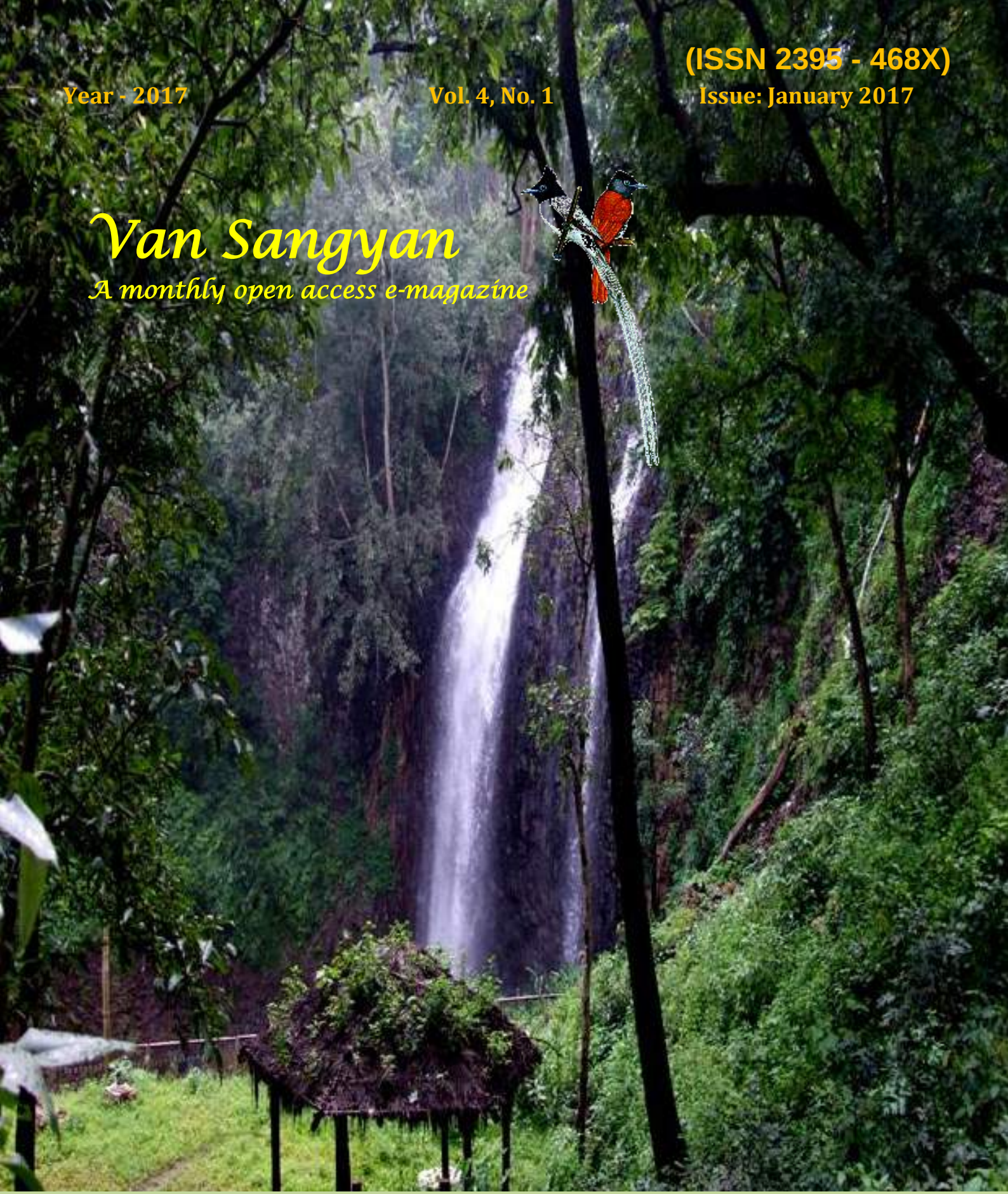
(ISSN 2395 - 468X)
Year - 2017 Vol. 4, No. 1 Issue: January 2017



Van Sangyan

A monthly open access e-magazine

Indexed in:

COSMOS Foundation
(Germany)

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

Van Sangyan

Editorial Board

Note to Authors:

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

by e-mail to vansangyan_tfri@icfre.org

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

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

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

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

From the Editor's desk

Sal (Shorea robusta) is beset by a number of pests and diseases. Among the insect pests in India, Hoplocerambyx spinicornis is the most destructive. Its larvae tunnel through the bark, sapwood and finally to the heartwood, causing death of the tree. The population of the pest keeps building up and if not checked may assume an epidemic level. Other insect pests include Diacavus furtivus and Xyleborus spp. The major fungal diseases include those caused by Polyporus shorea and Polyporus gilvus. The semi-parasite Loranthus scurrula can also cause increment losses. Insects associated with dying saplings, poles and trees of Shorea robusta in India are divided into three groups according to whether they bore in the bark or wood, cause defoliation or suck the sap. Only one species of borer, the Cerambycid, Hoplocerambyx spinicornis, Newm., is capable of attacking and killing healthy trees of any age and size, although it normally breeds in freshly felled timber, windfalls, etc.

Attacked trees die off from the crown downwards by sudden withering of the foliage in spring or autumn, and exude resin profusely at points where the larvae bore in the bark, though the roots remain healthy. Remedial measures include the removal of attacked trees before the next monsoon, collection of beetles in July-August and utilization of trap-trees. These bore in the bark and wood of crown and branches, and some species of Xyleborus and some weevil and Prionid larvae bore into the roots, often to considerable depths below ground-level. Dying-off, when due to secondary borers, is preceded by drying-up of the crown without sudden withering of the foliage; no resin is exuded at oviposition points and the roots are dead in parts or diseased, the wood being invaded by hyphae. The bark remains closely attached to the bole or separates loosely in patches with discolouration of the sapwood. Of these borers, Sphaerotrypes siwalikensis, Stebb., requires fresh moist bark for its brood tunnels, as the brood fails to develop under dry conditions, and in healthy trees a flow of resin drives out or kills the beetles. Acmaeodera stictipennis, Lap. & Gory, Chrysobothris beesoni, Obenb., Sinoxylon anale, Lesne, and Xylotrechus smei, Lap. & Gory, are associated with stag-headed and dried out crowns, and Aeolesthes holosericea, F., Diorthrus cinereus, F., and Coptops aedifi-cator, F., are found in the larger branches and boles of trees thus affected. The occurrence of these species in the absence of others suggests that the trees either died of drought or were attacked after the crown and bole had begun to dry out. The presence of the Tineid borer, Gerontha captiosella, Wlk., is associated with a saprophytic bark fungus, Hypoxylon annulatum, which produces a charcoal-like formation beneath the outer dead bark easily mistakeable for scorching by ground fires. Dying-off with drought as the sole predisposing factor is rare, as there are usually complications in the shape of root diseases. Dying-off in localities of high rainfall or under normal weather conditions is mainly associated with Diapus furtivus, Samps., Crossotarsus saundersi, Chap., Xyleborus spp., Dialeges pauper, Pasc., and Xylotrechus buqueü, Lap. & Gory. Attack by Hoplocerambyx spinicornis, as a secondary borer, indicates an unresistant condition in the tree at the beginning of the rains. Secondary borer attack is distinguished from primary attack in regions of high rainfall by the diversity of the incidence of the constituent species. The successful application of remedial measures against secondary borers saves the timber but does not stop dying-off. The primary causes of dying-off are probably referable to physiological disturbances resulting from meteorological conditions.

This issue of Van Sangyan contains two articles on Insect pest problem in intensive plantation of sal and sal borer and it's management (in Hindi). There are also useful articles, such as Floral diversity in Satkosia Tiger Reserve, Odisha, Blue carbon and its change in dimension due to COP 21, Soil health (in Hindi), Present and future scenario of farmer's income, Oroxylum indicum- a sacred medicinal plant (in Hindi), Exotic tropical fruit trees and their utility, Lichens as air pollution bio indicators, Exploration of medicinal plant resources and their utilization in Sarguja, Diversity of macro-fungi, Serpula spp. in central India, Tree stratum and forest floor biomass in the proximity of collieries and Biodiversity of Ailurus fulgens and Aristolochia elegans.

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

Looking forward to meet you all through forthcoming issues.

Dr. N. Roychoudhury
Scientist G & Chief Editor

Contents

Insect pest problem in intensive plantation of sal (*Shorea robusta*) in Chhattisgarh

P. B. Meshram and N. Kulkarni
Forest Entomology Division
Tropical Forest Research Institute
(Indian Council of Forestry Research & Education, Ministry of Environment, Forests and Climate Change, Govt. of India)
P.O. RFRC, Mandla Road, Jabalpur-482021 M.P.

Introduction

Sal, *Shorea robusta* Gaertn. f. (family-Depterocarpaceae) is a large deciduous, resiniferous tree having majestic shining foliage. This potential tree species is one of the most important timbers of India both ecologically and economically (Tewari, 1995). Chhattisgarh is the second largest state with extensive sal forest 17,165 sq km i.e. 46% of the total forests of the state (Bajpaee, 1982). It is widely distributed in central and north India and constitutes an important ecosystem, which provides cool and calm environment rich in biodiversity. This is a slow growing species in its natural habitat and sometimes in non-irrigated plantations. But the potential of sal as fast growing species has been explored by raising intensive management like drip irrigation and high inputs. In Chhattisgarh state, the intensive plantation of sal is a recent approach in plantation strategy.

Forest Division, Bilaspur has raised the intensive plantations at Bendarchua beat, Ratanpur range in 10 ha area during 2013-14. For plantations, seedlings of sal were obtained from Bhaisajhar nursery, Forest Division, Bilaspur. The total numbers of plants are 25,000 with spacing 2x2 m. As per the information given by the staff, at the time of plantation, applied 500 g Farm Yard Manure (FYM) + Neem cake 250 g + Bonemill 250 g. The adjoining areas of this plantation are miscellaneous sal forest. The average height is 1.67 m and basal girth is 11.6 cm.

In pursuance to the information regarding the pest problem received from Divisional Forest Officer, Bilaspur, CG State Forest Department on dated 08th November, 2016 during the training programme at Van Vigyan Kendra, Bilaspur. A team of Scientists of Tropical Forest Research Institute, Jabalpur visited and surveyed the entire plantation areas. This plantation is now facing the problem of insect pest attack at different phase of growth and reported the presence of girdle beetle *Celosterna scabrator*, termite, leaf binder *Nephopteryx rodabasalis*, leaf defoliating scarabaeid beetles, leaf gall forming insect, *Trioza* spp (Fig.1-7). The major insect pests are *C. scabrator* and termite, *Odontoermes* spp and minor insect pests are *N. rhodabasalis*, *Trioza* spp., and scarabaeid beetles. The incidence of girdle beetle ranges from 30-50 per cent (average 27.85 per cent) whereas the termites 30-50 per cent (average 37.14 per cent) were recorded. The beetle *C. scabrator* Fab.(Coleoptera: Cerambycidae) are nocturnal habitat and eat irregular patches of bark of green twigs, sometimes girdling and killing shoots / twigs. No epidemics of this insect pest have been reported on sal (Beeson, 1941). A subterranean termite *Odontotermes* spp occur in plains. It forages by runways to bark of stem of which it makes mud plaster covering. It is

frequently also injurious to roots. The other important insect pests like defoliators and leaf gall maker are observed in less incidence and minor.

Possible control measures to encounter the present problem

The staff of Forest Division, Bilaspur has applied the insecticide Mol-76% (Dichlorvos) i.e. 50 ml in 12 lit of water against these insect pests. But the incidence of these insect pests is increased day by day. The team of the Scientists of TFRI, Jabalpur suggested the following control measures.

1. Installation of light trap unit for collection of adult beetle population from plantations for reducing the oviposition rate.
2. Remove the mud plaster of termite and applying Chlorpyrifos 20 EC @ 0.05% i.e. 2.5 ml per lit of water. One lit of solution should be applied around the plant and same solution mix with lime and should be applied on the stem up to 30-60 cm.
3. Foliar spraying of Monocrotophos 36 EC@ 0.05% (1.4 ml per lit of water) two times at 15 days interval should be done.

References

Bajpaee, H.V. (1982). Working Plan for the Sal Forests of Mandla District, M.P. Govt. of Madhya Pradesh. 455 pp.

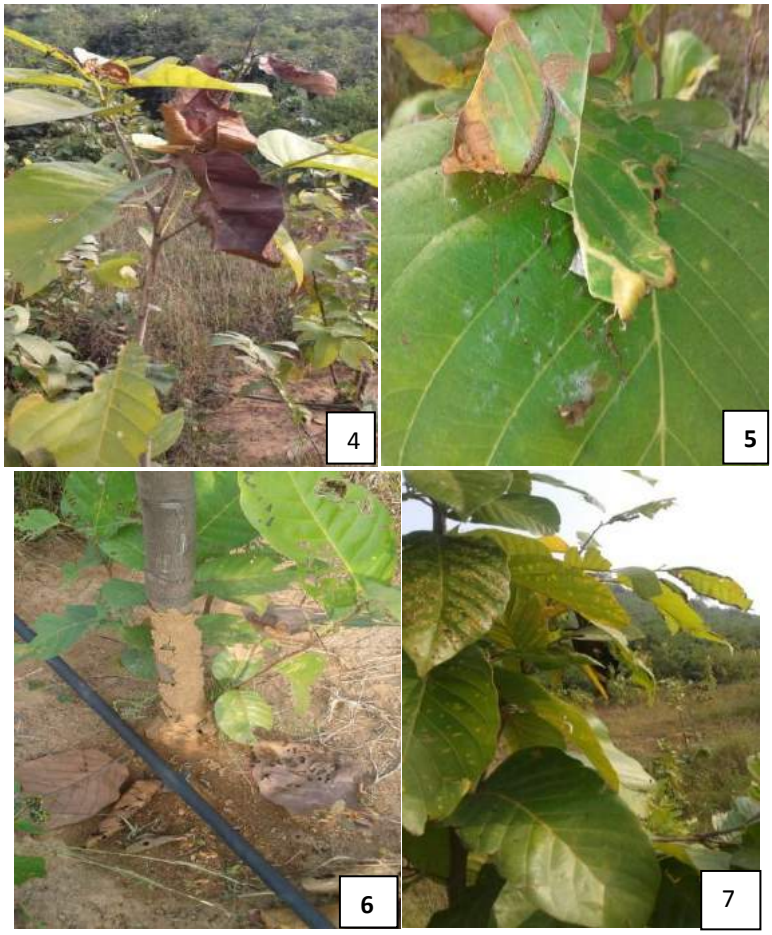
Beeson, C.F.C (1941). The Ecology and Control of the Forest Insects of India and the Neighbouring Countries. Vasant Press, Dehradun, 1007 p.

Tewari, D.N. (1995). A Monograph on Sal *(Shorea robusta* Gaertn.f.*).* International Book Distributors, Dehradun, 276 pp.

1

2

3



Figs. 1. Intensive sal plantation; 2. Beetle *Celosterna scabrator*; 3. Girdling plant by beetle; 4. Dying shoot damaged by beetle; 5. Larva of *Nephoteryx rhodabasalis* defoliate plant; 6. Termite plaster on stem; 7. Gall forming insect, *Trioza* spp damaged leaves

साल वनों में साल छिद्रक का प्रकोप एवं प्रबंधन

एन. रॉयचौधुरी एवं राजेश कुमार मिश्रा

उष्णकटिबंधीय वन अनुसंधान संस्थान

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

जबलपुर (म.प्र.)

साल वृक्ष हमारे भारतवर्ष में पारिस्थितिकीय एवं आर्थिक दृष्टि से महत्वपूर्ण वृक्ष है। भारत में साल वन लगभग 1, 05, 790 वर्ग कि. मी. क्षेत्र में फैला हुआ है, जिसमें 38,000 वर्ग कि. मी. क्षेत्र उड़ीसा, यह पूरे देश के साल वन क्षेत्र का लगभग 35.92 प्रतिशत तथा 24408.45 वर्ग कि.मी. क्षेत्र मध्यप्रदेश एवं छत्तीसगढ़ में है। यह पूरे देश के साल वन क्षेत्र का 25 प्रतिशत है।

वनों में पाये जाने वाले अन्य वृक्षों की तुलना में साल में सबसे ज्यादा कीटों की संख्या पायी जाती है। इसमें लगने वाले कीटों की लगभग 346 प्रजातियों की पहचान की जा चुकी है। जिसमें गण कोलियोप्टेरा (191), लेपिडोप्टेरा (126), थाइसेनोप्टेरा (10), आइसोप्टेरा (9), हेमिप्टेरा (4), आर्थोप्टेरा (4),एफिमेरोप्टेरा (1) तथा हाइमेनोप्टेरा (1) शामिल है (सारणी-1)। इन कीटों का प्रकोप साल के पौधे से लेकर पूरे वृक्ष बनने तक सभी अवस्थाओं में, यहाँ तक कि इमारती लकड़ी तथा फर्नीचर तक में पाया जाता है।

सारणी 1 - साल में पाये जाने वाले कीट

गण	कीट प्रजातियों की संख्या	कीट प्रजातियों का प्रतिशत
कोलियोप्टेरा	191	55.20
लेपिडोप्टेरा	126	36.42
थाइसेनोप्टेरा	10	2.89
आइसोप्टेरा	9	2.60
हेमिप्टेरा	4	1.16
आर्थोप्टेरा	4	1.16
एफिमेरोप्टेरा	1	0.29
हाइमेनोप्टेरा	1	0.29
कुल	**346**	**100.00**

लगभग 155 कीट प्रजाति जीवित वृक्षों में देखी गयी है, जिसमें मुख्यतः पत्ती खाने वाले (112), लकड़ी छेदने वाले या छिद्रक (20), बीजों को खाने वाले (19), तथा रस चूसने वाले (4) प्रजातियां हैं (सारणी-2)। इनमें कुछ आर्थिक रुप से अत्यधिक हानिकारक हैं।

सारणी 2 - जीवित साल वृक्ष में पाये जाने वाले कीट

कीट	कीट प्रजातियों का प्रतिशत*	गण	कीट प्रजातियों की संख्या
पत्ती खाने वाले	112 (72.26)	कोलियोप्टेरा	15
		लेपिडोप्टेरा	92
		आर्थोप्टेरा	1
		थाइसेनोप्टेरा	4
छिद्रक (तना एवं जड़ भेदक)	20 (12.90)	कोलियोप्टेरा	10
		एफिमेरोप्टेरा	1
		आइसोप्टेरा	1
		लेपिडोप्टेरा	2
		आर्थोप्टेरा	3
		थाइसेनोप्टेरा	3
बीजों को खाने वाले	19 (12.26)	कोलियोप्टेरा	6
		लेपिडोप्टेरा	11
		थाइसेनोप्टेरा	2
रस चूसने वाले	4 (2.58)	हेमिप्टेरा	4
कुल			**155**

***क्षति की प्रकृति पर आधारित**

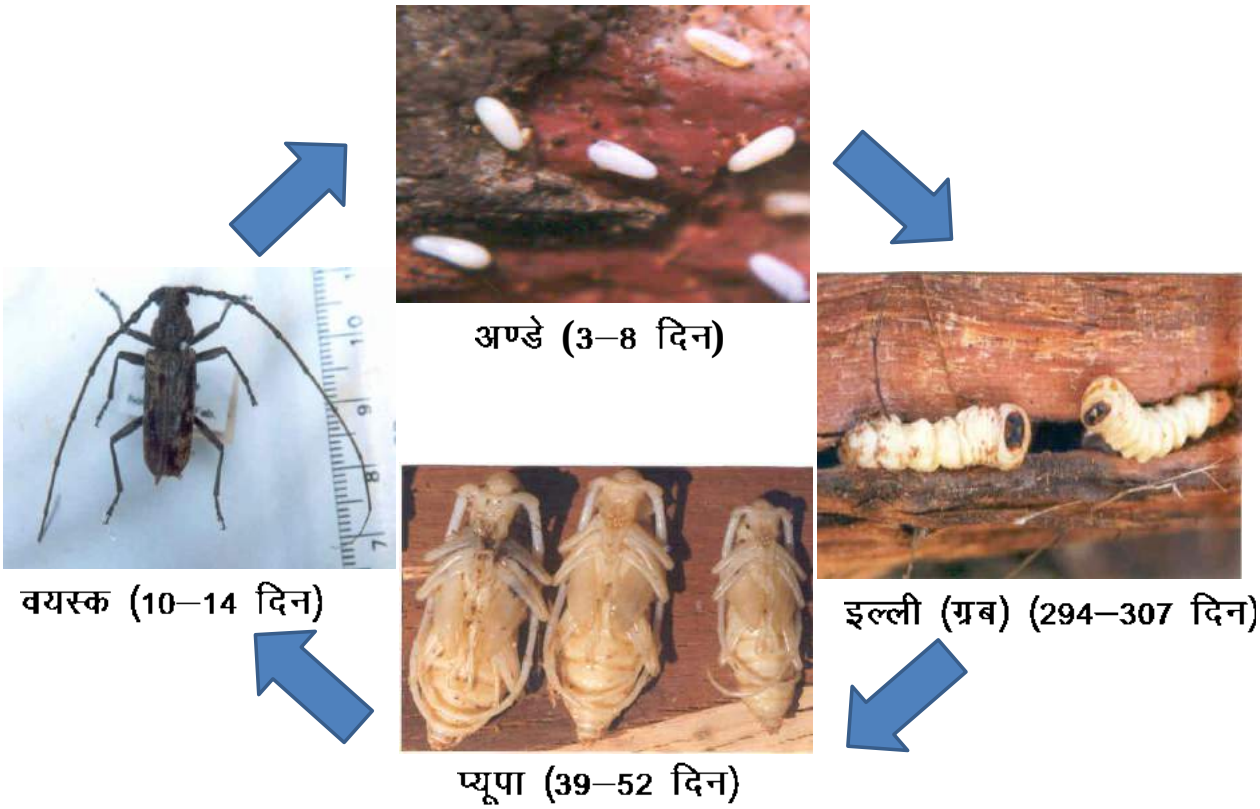
उत्तरप्रदेश, उत्तराखण्ड, मध्यप्रदेश एवं छत्तीसगढ़ के साल वनों में वृक्ष की सभी अवस्थाओं में नुकसान पहुंचाने वाले अन्य कीटों के अलावा तना छिद्रक कीट का अत्यधिक प्रकोप पाया जाता है, जो वृक्ष को बहुत ज्यादा नुकसान पहुंचाते हैं। यह कीट साल के तने को भेदकर उसे खाता है तथा अन्दर में सुरंग बनाकर रहता है। इस कीट का नाम साल छिद्रक कीट; साल छिद्रक - *होप्लोसिराम्बिक्स स्पाईनिकॉर्निस* है। सामान्यतः यह साल छिद्रक के नाम से प्रचलित है।

साल छिद्रक के बारे में जानकारी

साल छिद्रक कीट गहरे भूरे रंग का, लम्बी एन्टीना (मूंछो) वाला बीटल (एक विशेष कीट समूह) होता है। इसकी लम्बाई 3 से. मी. से 7 से. मी. तक होती है। इसके दो कांटेदार एन्टीना होते हैं, जो कि इसके शरीर की लम्बाई से भी ज्यादा हो सकते हैं। यह कोलियोप्टेरा गण के सिराम्बिसिडी कुल के अन्तर्गत आता है। इसका वैज्ञानिक नाम *होप्लोसिराम्बिक्स स्पाईनिकॉर्निस* है। इसका जीवन चक्र एक वर्ष का होता है, जिसमें इनकी चार अवस्थाऐं होती हैं: अण्डा, इल्ली (लार्वा), प्यूपा एवं वयस्क।

साल छिद्रक का जीवन चक

अण्डे - यह चावल के दानो के समान सफेद रंग के होते है । अण्डो में से 3-7 दिनों में 80-90 प्रतिशत इल्लियां निकल जाती है ।



चित्र 1: साल छिद्रक का जीवन चक्र

इल्ली

अण्डो से इल्लियां निकालने के तुरन्त बाद ही छाल के अन्दर प्रवेश करती हैं तथा सबसे पहले रसदार लकड़ी (Sapwood) को खाती हैं, धीरे-धीरे इल्ली रसदार लकड़ी (Sapwood) से मजबूत लकड़ी (hardwood) में प्रवेश कर उसे खाती है । इल्लियों द्वारा किये गये बोर का अनुमान वृक्षों के नीचे गिरे हुए बुरादे से लगाया जाता है । यह इल्ली अवस्था 294-307 दिनों तक रहती है ।

प्यूपा

प्यूपा बनने से पहले इल्लियां क्षितिज के समांतर दिशा में रसदार लकड़ी (Sapwood) में सुरंग बनाकर प्यूपल चेम्बर का निर्माण कर प्यूपेशन में चली जाती है । प्यूपेशन का समय 39-52 दिनों का होता है । अविकसित वयस्क अवस्था मई माह तक रहती है । जून माह में अवयस्क पूर्ण रूप से वयस्क में परिवर्तित हो जाता है, तथा जून माह में पहली बारिश के साथ वयस्क बाहर निकलकर जोड़ी बनाते है । वयस्क कीटों में मादा कीट कि आयु 38 दिन तथा नर कीट की आयु 9 दिन मानी जाती है ।

वयस्क

साल छिद्रक के वयस्क कीट साल छिद्रक से संक्रमित वृक्षों से जून की पहली बारिश से जुलाई के अंत तक बाहर निकलते रहते हैं । वयस्क कीट काले या रक्तिम भूरे रंग के होते है, जिसकी लम्बाई 3-7 से.मी. होती है । यह बाहर निकलने के तुरंत बात ही जोड़े बना लेते हें । मादा वयस्क निषेचन क्रिया के बाद 7-9 दिनो में अण्डे देते है ।

मादा वयस्क अपने अण्डे वर्तमान में गिरे हुए वृक्षों मे अथवा जीवित खड़े वृक्षों के तनों अथवा शाखाओं के छाल में देती है। मादा वयस्क अपने जीवन काल में 100-300 अण्डे तक देती है।

साल छिद्रक का व्यवहार

साल छिद्रक कीट का वयस्क *होप्लोसेराम्बिक्स स्पाईनिकॉर्निस* हर साल मानसूनी वर्षा की पहली बौछार पर जून माह के मध्य से साल वृक्षों से निकलना शुरू करते हैं। जून के महीने में यदि वर्षा कुछ देर से माह के अंत में हो जाती है तो वयस्क कीट कुछ दिनों के बाद निकलने लगते हैं। परन्तु यदि वर्षा जुलाई महीने के अंत तक नहीं होती है तो वयस्क कीट जब तक बारिश न हो, नहीं निकलते है। हर बारिश की बड़ी बौछार पर वयस्क कीट के समूह साल वृक्षों से बाहर निकलते है और यह प्रक्रिया पूरे मानसून भर चलती रहती है।

वयस्क कीट सूरज की रोशनी में खासतौर पर दिन के अपरान्ह 1 बजे से शाम के 5-6 बजे तक अतिक्रियाशील रहते हैं। ये सूरज की सीधी रोशनी से दूर छायादार जगह पर रहना पंसद करते हैं। सामान्यतः ये वयस्क जंगल में रूक-रूक कर कम ऊंचाई की उड़ान भरते हैं और काफी तेजी से पेड़ की छाल पर, छायादार जगहों पर जैसे गिरे या कटे पेड़ या लठ्ठे के नीचे, छाल के बीच-बीच में, बड़ी पत्तियों, इत्यादि में छिपकर इकट्ठे हो जाते हैं। आकाश पर छाये बादल या रिमझिम से कुछ तेज वर्षा होने पर ये वयस्क खुले में लंबी दूरी की उड़ान भी भर सकते हैं।

वयस्क कीट, साल वृक्ष की छाल को काटते हैं। खासतौर पर ये आंतरिक जीवित छाल और इससे निकलने वाले ताजे रस और बाह्य काष्ठ की ओर बहुत आकर्षित होते हैं। इस रस का ये तब तक सेवन करते हैं, जब तक कि उनकी खाने की नली पूरी भर नहीं जाती है। ताजे रस के अतिरिक्त ये वयस्क कीट, पानी की बूंदों को भी पीते रहते हैं। वयस्क कीट, बिजली की रोशनी की ओर कम मात्रा में आकर्षित होते हैं, परन्तु साल वृक्ष के ताजे रस की सुगंध इन वयस्क कीटों को लगभग 2 कि.मी. की दूरी से अपनी ओर आकर्षित कर लेती है। अतः कीटों के इस व्यवहार का प्रयोग इन्हें पकड़ने में किया जाता है। साल छिद्रक वयस्क कीट सामान्यतः मृत वृक्ष, जैसे - गिरे हुए वृक्षों, हवा-आंधी और बीमारी से टूटे वृक्षों पर अंडे देते हैं। पूर्ण स्वस्थ साल वृक्ष पर अंडे तब तक नहीं दिये जाते जब तक कि मृत वृक्ष इतने नहीं हो जाते कि सारे वयस्क उन पर अंडे दे सकें। जीवित साल वृक्ष जिनकी गोलाई 91-150 सें.मी. होती है, की छाल पर उपस्थित छेद, लंबी नाली नुमा खांचों पर, वृक्ष के निचले नम एवं सरस हिस्सें, गिरे हुए वृक्षों के नीचे अथवा खड़े वृक्षों के छायादार हिस्से में अंडे देते हैं।

अंडे से निकली हुई अवयस्क इल्ली (ग्रब) सफेद रंग की होती है। यह साल वृक्ष की छाल को छेदते हुए धीरे-धीरे जीवित छाल और बाह्य काष्ठ से होते हुए ऊपर और नीचे बढ़ती है। बाह्यकाष्ठ से निकलने वाले द्रव या राल यदि ज्यादा मात्रा में हो तो वह छोटी इल्ली अंदर प्रवेश नही कर पाती है और राल मे डूबकर मर जाती है। यदि राल पर्याप्त मात्रा में वृक्ष से नहीं निकलता है तो ये इल्ली या ग्रब सफलतापूर्वक जीवित रहते हैं और वृक्ष के अंदर प्रवेश कर जाते हैं। ग्रब्स, बाह्यकाष्ठ को खाकर आड़ी - तिरछी सुरंगे बनाते हैं। जिसमें लकड़ी का बुरादा भरा रहता है, जब कीटों की संख्या अधिक होती है तो वृक्षों को पोशक तत्व पहुंचाने वाली नलियां पूर्णरुप से नष्ट हो जाती है

जिससे वृक्ष को भोजन व पानी मिलना बंद हो जाता है और वृक्ष सूख जाता है। दिसम्बर माह से यह इल्लियाँ (ग्रब्स), मध्यकाष्ठ में चौड़ी सुरंग या प्यूपल कक्ष बनाकर एवं निकासी हेतु एक सुरंग बनाकर, प्यूपल कक्ष में प्यूपा की स्थिति में चली जाती हैं।

साल छिद्रक का संक्षिप्त इतिहास

मध्य प्रदेश के मण्डला क्षेत्र के आस-पास के वनों में सर्वप्रथम वर्ष 1923-28 के दौरान लगभग 70 लाख साल वृक्ष इस कीट से प्रभावित हुए थे। इसके उपरान्त वर्ष 1950-1955, 1959-62, 1979-82 एवं 1996-2001 की अवधि में यह प्रकोप विभिन्न साल वनों में महामारी के रुप में पाया गया। वर्ष 1996-2001 के दौरान तत्कालीन मध्यप्रदेश एवं छत्तीसगढ़ क्षेत्र में इसके प्रकोप से 3 लाख हेक्टेयर साल वन में लगभग 40 लाख साल वृक्ष प्रभावित हुए थे। यदि किसी ईकाई क्षेत्रफल में साल छिद्रक से ग्रसित वृक्षों का प्रतिशत एक प्रतिशत से अधिक होता है तो इसे महामारी की शुरुआती अवस्था समझी जाती है। अभी तक देश के विभिन्न प्रदेशों से 21 प्रकोपित क्षेत्र पाए गये हैं। सबसे पहले वर्ष 1905 में बालाघाट, मध्य प्रदेश में प्रकोपित क्षेत्र रिकार्ड किया गया था। वर्ष 1997-2000 में छत्तीसगढ़ में साल छिद्रक का प्रकोप पाया गया था। वर्तमान में जगदलपुर वन मण्डल के कलिंग परिक्षेत्र तथा बस्तर वन मण्डल के कांकेर परिक्षेत्र में इसका प्रकोप पाया गया है।

साल छिद्रक कीट से ग्रसित वृक्षों की संख्या बढ़ने के संभावित कारण

उत्तर एवं मध्य भारत में साल छिद्रक कीट साल के वनों में मूलतः साल के गिरे हुए वृक्षों का छिद्रक कीट हैं। परन्तु कभी-कभी जब जलवायु दो-तीन वर्षों में इनके अनुकूल रहती है और ये अधिक संख्या में पैदा हो जाते हैं तो यह साल के जीवित खड़े वृक्षों को भी ग्रसित करने लगते हैं और महामारी का रूप धारण कर लेते हैं। यह महामारी किसी एक कारण से नहीं होती है। वातावरण की जलवायु एवं कई जैविक कारणों से जब प्राकृतिक असंतुलन हो जाता है तब इन कीटों की संख्या में अचानक बढ़ोत्तरी हो जाती है। संक्षेप में इन कारणों का वर्णन निम्न है:-

जलवायु की अनुकूलता

वातावरण एवं मौसम जैसे तापमान, आद्रता एवं वर्षा, साल के छिद्रक कीट की संख्या को कम या अधिक करने में महत्वपूर्ण भूमिका निभाते हैं। इस कीट के जीवन चक्र में इन कारकों का अनुकूल होना इस छिद्रक के प्रजनन में आवश्यक है। अतः जलवायु में इन कारकों की अधिकता, कमी और असमयता से जलवायु-संतुलन बिगड़ जाता है जिससे कभी-कभी कीट की संख्या बढ़ कर महामारी के रूप में परिलक्षित हो जाती है, या फिर इनकी संख्या में कमी आ जाती है या कभी-कभी इनकी संख्या समाप्त हो जाती है।

प्रयोगों से पाया गया कि मादा कीट के अण्डे दिये जाने की प्रक्रिया मुख्य रूप से आद्रता एवं तापमान पर निर्भर है। जब कभी वातावरण में आद्रता 55 प्रतिशत से कम होती है तो इस कीट के अण्डे की संख्या में कमी आ जाती है। वातावरण में 80 प्रतिशत से 90 प्रतिशत आद्रता इस कीट की मादा द्वारा अण्डे देने के लिए उपयुक्त मानी जाती है, परन्तु जुलाई-अगस्त माह में औसतन 90 प्रतिशत आद्रता इन मादा वयस्कों के सर्वाधिक संख्या में अण्डे देने के लिए उपयुक्त होती है। वातावरण के तापमान का अधिक व कम होना भी मादा वयस्क के अण्डे देने को

प्रभावित करता है। मादा कीट 26° से 30° से0 के बीच में अण्डे देती है। इससे कम व अधिक तापमान में ये अण्डे नहीं देते हैं। इस प्रकार मादा कीट द्वारा दिये जाने वाले अण्डों और वातावरण के तापमान व आद्रता का कीट के अण्डे देने से सीधा सम्बन्ध होता है जो कि वर्षा के आगमन पर निर्भर करता है। नर एवं मादा कीट का जीवनकाल भी मौसम के अनुसार ही घटता या बढ़ता है। यदि उपयुक्त तापमान व आद्रता हो तो मादा कीट 38 दिन तक जीवित रहते हैं और इस जीवनकाल में ये 500 तक अण्डे देते हैं। मध्यप्रदेश में वर्ष 1995-96 से शुरू हुई इस छिद्रक की महामारी में देखा गया कि साल वनों में 1995 से 2000 तक समान रूप से प्रतिवर्ष अच्छी वर्षा हुई जो 15 जून के आसपास से आरम्भ होकर सितम्बर - अक्टूबर तक होती रही। यह समय कीटों के प्रजनन में सम्भवतः अत्यधिक अनुकूल रहा जिससे साल छिद्रक कीट महामारी के रूप में फैल गया। यह भी देखा गया कि यदि वर्षा का आगमन जून माह में देर से होता है तो वयस्क कीटों का वृक्षों से निकलना भी लम्बित हो जाता है जिससे अण्डों की संख्या में कमी आ जाती है। इसी प्रकार यदि वर्षा समय पर शुरू हो जाती है, परन्तु जुलाई - अगस्त के माह में मौसम शुष्क रहता है तो दिये गये अण्डे भी अधिक तापमान के कारण मर जाते हैं और इनसे इल्लियाँ नहीं बन पाती हैं। वर्ष 2001 में, यद्यपि वर्षा का आगमन सही समय पर हुआ परन्तु कम मात्रा में हुई तथा जुलाई माह में 15 दिनों के लगभग का समय अवर्षा का रहा जिसके फलस्वरूप वातावरणीय तापमान बढ़ गया एवं आद्रता में अचानक कमी आ गई जिससे मादा कीट ने जो अण्डे दिये थे, वे सूखकर नष्ट हो गये। जिन अंडों से वर्षाकाल के दौरान इल्ली निकल गई थी, वह भी आद्रता की कमी व अधिक तापमान के कारण नष्ट हो गये और वनों में साल वृक्षों पर इस छिद्रक का प्रकोप कम होने लगा। इससे वर्ष 2002 में भी यद्यपि मानसून जून माह से ही सक्रिय रहा किन्तु जुलाई से लगभग 15 दिनों के लिए पूर्णतया अवर्षा की स्थिति रही, जिससे पुनः गत वर्ष की भांति इस कीट के प्रकोप में कमी आती रही।

भूमि में नमी व उर्वरता की कमी

वन भूमि मृदा के पथरीली होने और उसमें आवश्यक तत्वों की कमी, वृक्षों की जड़ों में वायु का अभाव, मृदा में पत्थरों का होना, इत्यादि नमी वाले साल वृक्षों को कमजोर बनाता है। अतः ये साल छिद्रक के प्रकोप को बढ़ा देता है।

साल वनों में मनुष्यों की गतिविधियों का दबाव

विगत वर्षों में साल छिद्रक कीट का प्रकोप उन स्थानों में अधिक मात्रा में पाया गया जिनके नजदीक मनुष्यों ने अपने घर बनाये हैं। मनुष्यों द्वारा साल की लकड़ियों को इकट्ठा कर ईंधन के लिए रखना जिसमें छिद्रक के अवयस्क पल रहे हों, साल के वृक्षों की वर्षा काल में कुल्हाड़ी आदि से कटे का निशान बनाना या काटना, पालतू पशुओं को साल वनों में चराई के लिए भेजना, आदि इसके संभावित कारण हैं। पशुओं के वन में घूमने व चराई से वन भूमि कठोर एवं इसमें पानी रोकने की क्षमता घट जाती है। इसके अतिरिक्त चराई से साल वनों में पौधों की कई प्रजातियां जो पर्यावरण संतुलन बनाये रखती है समाप्त हो जाती हैं जिससे भूमि की उर्वरता कम होने लगती है।

पाले का प्रभाव

कुछ साल वनों में ठंड के मौसम में अत्यधिक पाला पड़ जाता है जिससे साल वृक्षों के ऊपरी शिखर सूख जाते है (चित्र 2) परन्तु नीचे की ओर वृक्ष हरा रहता है। ऐसे वृक्ष कमजोर हो जाते हैं और साल छिद्रक कीट के अतिरिक्त कई अनेक कीटों से ग्रसित हो जाते हैं।

चित्र 2: पाले से ग्रसित साल वृक्ष

साल वृक्षों का फफूंद जनित बीमारियों से ग्रसित होना

चित्र 3: फफूंद जनित बीमारियों से ग्रसित साल क्षेत्र

साल वनों में कभी-कभी फफूंद जनित बीमारियाँ जैसे *मेक्रोफोमिना फेसिओलिना* एवं *फ्यूजेरियम आक्जीस्पोरम* आदि नामक फफूंद से होने लग जाती है, जिसके प्रभाव से साल वृक्ष शिखर से सूखने लग जाते हैं। यह बीमारी साल के छोटे या बड़े दोनो प्रकार के वृक्षों में सामानतः रहती है (चित्र - 3)। यदि इन वृक्षों को वनों से नही हटाया गया तो इन वृक्षों पर साल छिद्रक कीट वर्षा ऋतु में अंडे दे देता है और यह इस छिद्रक कीट के प्रजनन में सहायक सिद्व होता है। इस प्रकार की स्थिती मोतीनाला क्षेत्र के अंतर्गत कुछ कक्षों में वर्ष 2004 के फरवरी माह में देखी गई।

प्राकृतिक शत्रुओं की कमी

प्रकृति में पाये जाने वाले प्रत्येक कीट के अपने कुछ प्राकृतिक शत्रु भी होते हैं जो इनकी संख्या को नियमित करने में सहायक होते हैं। साल छिद्रक कीट को नष्ट करने वाले अनेक परजीवी, परभक्षी एवं बीमारियां साल वनों में पायी जाती हैं जिससे इस साल छिद्रक कीट की संख्या नियंत्रित रहती है। साल छिद्रक के कुछ प्रमुख शत्रुओं में कुछ ब्रेकोनिड परजीवी जैसे *डियोक्रायस देहरीन्सिस, इक्जोब्राकोन मनुलिपेनिस,* परभक्षी जैसे *एलस सॉर्डिडस* एवं फफूँद एवं वैक्टीरिया जनित बीमारियां हैं। ये सभी साल छिद्रक कीट की संख्या प्रकृति में नियंत्रित करने में सहायक होते हैं। परभक्षी *एलस सॉर्डिडस* (चित्र 4) के अवयस्क साल छिद्रक कीट के अवयस्कों को वृक्षों के अन्दर छिद्रक कीट द्वारा बनाई गई नालियों में प्रविष्ट होकर साल छिद्रक के अवयस्कों को अपना भोजन बनाते हैं। इसके अतिरिक्त साल छिद्रक कीटों को खाने वाले अनेक पक्षियों की उपस्थिति से भी साल छिद्रक कीटों की संख्या प्रकृति में

नियंत्रित होती है। प्राकृतिक रूप से ये परजीवी, कीट भक्षक एवं बीमारियां प्रत्येक मौसम में सामान्यतः साल छिद्रक कीट को कम करते रहते हैं। जलवायु में असंतुलन की दशा में इनकी संख्या में कमी या बढ़ोत्तरी होती है। अतः उपरोक्त सभी कारकों का साल छिद्रक कीट की संख्या बढ़ाकर महामारी के रूप में परिवर्तित करने एवं कम करके महामारी से बचाने में महत्वपूर्ण योगदान होता है।

वयस्क कीटों को अपनी ओर आकर्षित करती है। अतः इन टूटे पेडों को ठंड के मौसम में वन क्षेत्रों से हटा लेना चाहिये। जिससे साल छिद्रक कीट एवं अन्य वन कीट ज्यादा मात्रा में बढ़ न पायें। परन्तु अधिकतर यह देखने में आया है कि इस प्रकार के साल वृक्ष, वन क्षेत्रों में गिरे रहते हैं और इन पर साल छिद्रक कीट पनपता रहता है। अतः ऐसे वृक्षों को या तो वन क्षेत्रों से हटा देना चाहिए या फिर इन गिरे वृक्षों का छिद्रक कीट से

चित्र 4: साल छिद्रक कीट का भक्षक कीट

समान उम्र के साल वृक्षों का एक साथ होना

प्रायः देखा गया है कि साल छिद्रक कीट का प्रकोप 90 से.मी. से 150 से.मी. परिधि के वृक्षों पर अधिक होता है। 90 से.मी. की परिधि से कम साल वृक्षों को यह छिद्रक कम हानि पहुंचाता है। एक समान उम्र के पौधों में यह छिद्रक तुलनात्मक रूप से अधिक पाया जाता है।

साल छिद्रक से ग्रसित साल वृक्षों को वनों से हटाना

साल छिद्रक कीट, वयस्क वृक्षों के टूटने अथवा आघात से निकलने वाले कोशिका द्रव की गंध से साल वृक्षों की ओर आकर्षित होते हैं। वर्षा ऋतु में तेज हवा या पानी से कुछ साल के पेड़ या इनकी शाखायें टूट कर गिर जाती हैं ऐसी दशा में टूटे स्थान से एक द्रव निकलता है जिसकी गंध इन ग्रसित होने से पूर्व छालरहित कर देना चाहिए। यह कार्य वर्षा काल से पूर्व हो जाना चाहिए। वर्षा ऋतु में वृक्ष की कटाई अथवा वृक्ष की टहनियों या तने को आघात पहुँचाने से यह गंध आने लग जाती है जो साल के इस कीट को करीब 2 कि.मी. तक की दूरी से अपनी ओर खींच लेती है। अतः जून से सितम्बर माह तक साल वृक्षों में किसी प्रकार का आघात, कटाई, छटाई इत्यादि नहीं करनी चाहिए।

साल छिद्रक का प्रबंधन

साल छिद्रक से ग्रसित वृक्षों का लक्षणों के आधार पर वर्गीकरण

ग्रसित साल वृक्षों का वर्गीकरण अथवा वृक्षों का लक्षणों के आधार पर गिनती करना, साल छिद्रक कीट की तीव्रता, क्षति एवं स्थिति का अनुमान

जानने के लिए उपयुक्त होता है । यह गिनती जनवरी - फरवरी में उनके लक्षणों के आधार पर की जाती है । ग्रसित सभी कक्षों में प्रत्येक प्रभावित वृक्ष को मार्गदर्शिका के अनुसार श्रेणीवार चिन्हित करना, जी.बी.एच. नोट करना तथा स्थल की जी.पी.एस. रीडिंग भी नोट किया जाना आवश्यक है । यदि साल छिद्रक की उपस्थिति पायी जाती है तो श्रेणी-1 से श्रेणी-3 तक के प्रभावित वृक्षों को साल वन क्षेत्र से हटा कर 4-5 कि0मी0 दूर स्थानान्तरित कर देना चाहिए । ग्रसित साल वृक्षों को लक्षणों के आधार पर निम्न 8 श्रेणियों में विभाजित किया जाता है (चित्र 5) -

श्रेणी-1

वृक्ष की पत्तियां गिर चुकी हो तथा सम्पूर्ण वृक्ष सूखा हो । वृक्ष के नीचे मुख्य तने के चारों ओर 7 से.मी. से अधिक ऊँचा बुरादे का ढेर होना ।

श्रेणी-2

वृक्ष की पत्तियां हरे या भूरे रंग की होकर सूखना शुरू हो गई हों, वृक्ष के नीचे मुख्य तने के चारों ओर 7 से.मी. से अधिक ऊँचा बुरादे का ढेर हो ।

श्रेणी-3

वृक्ष का शिखर सूखा, बिना पत्तियों के अथवा भूरे रंग की या मुरझाई पत्तियाँ, परन्तु तने के निचले हिस्से में कुछ जीवित, पत्तीयुक्त शाखायें तथा मुख्य तने के पास बुरादे के ढेर 7 से.मी. से अधिक ऊँचा तक हो ।

श्रेणी-4

वृक्ष का शिखर शिखर जीवित तथा हरा, नवोदित शाखाएं हरी, वृक्ष के मुख्य तने के पास 7 से.मी. से अधिक बुरादे का ढेर हो ।

श्रेणी-5

वृक्ष शिखर का आधा भाग जीवित तथा शेष भाग मुरझाई पत्तियों युक्त या मृत जिसमें पत्तियाँ गिर गई हों। हरी नवोदित शाखाएं तथा वृक्ष के मुख्य तने के नीचे 7 से.मी. ऊचाई से कम बिखरा हुआ बुरादा हो।

श्रेणी-6

वृक्ष का केवल ठूंठ तथा उसके चारों ओर बुरादे का ढेर।

श्रेणी-7

वृक्ष का शिखर जीवित तथा हरा,

नवोदित शाखायें हरी, तने से प्रचुर मात्रा में गोंद या राल निकला हुआ, बुरादा आसपास छितरा हुआ।

श्रेणी - 8

स्वस्थ वृक्ष, बिना आसपास बिखरे बुरादे वाला एवं साल छिद्रक क्षति से मुक्त।

उपरोक्त प्रकार से वर्गीकृत श्रेणियों की संख्या का आंकलन दिसम्बर से फरवरी तक कर लेना चाहिए तथा नियमानुसार उच्च अधिकारियों को अवगत कराकर कार्यवाही करनी चाहिए।

चित्र 5: साल छिद्रक ग्रसित वृक्षों का श्रेणीकरण

साल छिद्रक के प्रबन्धन हेतु आवश्यक सुझाव

1- ग्रसित सभी कक्षों में प्रत्येक प्रभावित वृक्ष को मार्गदर्शिका के अनुसार श्रेणीवार

चिन्हित करना, जी.बी.एच. नोट करना तथा स्थल की जी.पी.एस. रीडिंग भी नोट किया जाना आवश्यक है।

2- चूंकि साल छिद्रक की उपस्थिति पायी गयी है अतः श्रेणी-1, श्रेणी-2 तथा श्रेणी-6 के प्रभावित वृक्षों को साल वन क्षेत्र से हटा कर 4-5 कि. मी. दूर स्थानान्तरित कर देना चाहिए।

3- प्रभावित स्थल पर लगभग 1 ट्रेप-ट्री प्रति हेक्टेयर की दर से प्रथम बारिश के बाद से ही ट्रेप-ट्री की कार्यवाही निम्नानुसार जाना अत्यन्त आवश्यक है।

चित्र 6: ट्रेप ऑपरेशन विधी का प्रदर्शन

टेप-ट्री आपरेशन

वृक्षों को श्रेणीवार चिन्हाकित करने एवं उसकी गणना करने के पश्चात साल छिद्रक के प्रबंधन हेतु टेप-ट्री विधी द्वारा वयस्क कीटों को पकड़ा जाता है, जिससे साल छिद्रक के विस्तार को रोका जा सकता है । टेप-ट्री आपरेशन निम्नानुसार किया जाना आवश्यक है (चित्र 6)।

1. प्रभावित स्थल पर लगभग 1 ट्रेप-ट्री प्रति हेक्टेयर की दर से प्रथम बारिश के बाद से ही ट्रेप-ट्री की कार्यवाही किया जाना अत्यन्त आवश्यक है।
2. ट्रेप लगाने के लिए वर्षा ऋतु के प्रारम्भ के साथ उचित स्थान जहाँ पर साल छिद्रक प्रभावित वृक्षों कि संख्या अधिक हो का चयन किया जाना चाहिए।
3. ट्रेप ट्री आपरेशन हेतु आंधी तूफान से गिरे हुए या टेढ़े मेढ़े साल वृक्ष जो आर्थिक दृष्टि से कम उपयोगी हो, ऐसे वृक्षों का चयन करना चाहिए।
4. ट्रेप ट्री आपरेशन हेतु साल वृक्ष की 60 से 80 से.मी. गोलाई एवं 2-3 मीटर लम्बाई की शाखा का उपयोग किया जाना चाहिए।
5. उपयुक्त शाखा के दोनों सिरे से 1-1 फुट तक छाल को रस निकलने तक पीटना चाहिए जिससे शाखा से साल की महक आने लगती है तथा शाखा की छाल ढीली पड़ जाना चाहिए।
6. इन शाखाओं को चयनित स्थानों में ले जाकर रखा जाना चाहिए तथा

उसे साल वृक्ष के पत्तों से अच्छी तरह से ढंक दिया जाना चाहिए।

7. अगले दिन सुबह सूर्योदय के पहले ट्रेप शाखा का निरीक्षण किया जाना चाहिए।
8. बीटल साल की गंध से आकर्षित होकर रस पीने हेतु शाखाओं में बैठते हैं इन बीटलों को सावधानी पूर्वक पकड़कर नष्ट कर देना चाहिए।
9. पकड़े गये बीटलों को इन्सेक्टिसाइड के घोल, मिट्टी के तेल में डूबोकर अथवा सावधानी से उनके सिर को तोड़कर मार देना चाहिए तथा उनके शरीर को जमीन में 2-3 फीट अन्दर दबा देना चाहिए।

Floral diversity in Satkosia Tiger Reserve, Odisha

K. Chandramohan[1] and P.V. Prasanna[2]
[1]Botanical Survey of India, Deccan Regional Centre
Hyderabad, Telangana-500048
[2]Botanical Survey of India, Central National Herbarium
Howrah - 711 103

Introduction

Documenting flora of any area is vital to unravel the floristic richness and in planning conservation programmes to save the fast eroding Biodiversity. As a part of this scientific programme, the present work on inventorying the flora of the Satkosia Tiger Reserve in Odisha State has been initiated. Satkosia Tiger Reserve ranks second largest home in Odisha for the population of Elephants and Tigers. The reserve comprises two adjoining sanctuaries viz., Satkosia Wildlife Sanctuary and Mahanadi Wildlife Sanctuary. It was declared as a Tiger Reserve in 2007 and is located between 20° 25' 12" to 20°45'36"N latitude and 84°39'00" to 85°05'24" E longitude with in an area of 964 sq. kms spread in four districts of Odisha- Angul, Cuttack, Boudh and Nayagarh. It is a meeting point of two bio-geographical regions of India: Deccan peninsular and Eastern Ghats, contributing to the rich biodiversity. The preliminary floristic survey carried out during 2013-16 in the Tiger Reserve has resulted in identifying 195 shrubs & tree species.

Vegetational types

The varied topographical features, high rainfall and geological conditions have favoured the formation of different Vegetational types. As per the Champion and Seth (1968), the sanctuary's vegetation falls in 4 major categories viz,. 1. Tropical semi-evergreen forests, 2. Moist peninsular Sal forests, 3. Northern dry mixed deciduous forests & 4. Riparian forests. Important features and species composition of these forest types are metioned below.

Tropical semi evergreen forests

These are mostly confined to the valleys around the hills with highest rainfall and lowest temperature in respective seasons. Top storey is dominated deciduous by trees, they are leafless for a short time only and the second storey is entirely evergreen. The main floristic elements are *Artocarpus lacucha, Bauhinia semla, Dillenia indica, Dillenia pentagyna, Ficus geniculata, Ficus nervosa, Firmiana colorata, Glochidion velutinum, Gmelina arborea, Litsea glutinosa, Litsea monopetala, Mangifera indica, Macaranga peltata, Melia azedarach, Nelsonia canescens, Radermachera xylocarpa* and *Vitex peduncularis.*

Moist peninsular sal forests

Moist peninsular high level sal forests

Sal dominant forests extend up over the hills on laterite trap and crystalline rocks. Regeneration is adequate. These are found in continuation with Semi- Evergreen forests with valleys and streams. These forests dominate with Sal with adequate regeneration and association of species like *Alstonia venenata, Amorphophallus paeoniifolius, Adenostemma lavenia, Bauhinia retusa, Callicarpa arborea, Careya arborea, Cipadessa baccifera, Dillenia indica, Shorea robusta, Spondias pinnata,*

Syzygium cumini, Suregada multiflora, Toona ciliata and *Ziziphus rugosa*.

Moist peninsular low level sal forests

These forests are similar to high level Sal forests with scanty population of Sal and with association of moist deciduous elements. There will be a scrub growth under the Sal with moderately cover of grass. Common elements in these forests are: *Adina cordifolia, Anogeissus acuminata, Anogeissus latifolia, Alstonia venenata, Bambusa bambos, Bauhinia vahlii, Bridelia retusa, Callicarpa tomentosa, Chelicostus speciosus, Clerodendrum viscosum, Clerodendrum infortunatum, Cycas orixensis, Dendrocalamus strictus, Dictyospermum ovalifolium, Dillenia pentagyna, Dracaena terniflora, Ecbolium ligustrinum, Ehretia laevis, Epithema dentatum* subsp. *hispidum, Floscopa scandens, Lagerstroemia parviflora, Macaranga peltata, Microchirita hamosa, Miliusa velutina, Mitragyna parvifolia, Pancratium zaylanicum, Petalidium barlerioides, Phaulopsis imbricata, Polyalthia cerasoides, Pterocarpus marsupium, Remusatia vivipara, Schefflera roxburghii, Shorea robusta, Terminalia arjuna* and *Uvaria hamiltonii.*

Northern dry mixed deciduous forests

This forest type is characterized by hardwood deciduous tree species. The canopy is open. These constitute grass lands, scrub forests that are chiefly confined to the hills at low elevations. The major plant species are *Adina cordifolia, Andrographis paniculata, Anogeissus latifolia, Buchanania cochinchinensis, Butea superba, Caseria tomentosa, Cassia fistula, Cleistanthus collinus, Celastrus paniculatus, Chloroxylon swietenia, Combretum album, Cryptolepis sinensis, Dalbergia latifolia, Dicliptera bupleuroides, Diospyros melanoxylon, Drimia indica, Gardenia latifolia, Gardenia resinifera, Garuga pinnata, Helicteres isora, Hemigraphis crenata, Hemigraphis hirta, Hemigraphis latebrosa, Holarrhena pubescens, Lannea coromandelica, Lobelia alsinoides, Mallotus philippensis, Mitragyna parvifolia, Pogostemon benghalensis, Protium serratum, Smilax zeylanica, Symphorema involucratum, Teminalia alata, Terminalia bellirica* and *Theriophonum minutum.*

Riparian forests

These forests chiefly occur along streams, nalas and along Mahanadi river banks. Major elements are *Acmella radicans* var. *debilis, Adenostemma lavenia, Aporosa octandra, Barringtonia acutangula, Carallia brachiata, Chionanthus ramiflorus, Cleistanthus patulus, Crateva nurvala, Dimorphocalyx glabellus, Diospyros malabarica, Ficus nervosa, Gnetum ula, Homonoia riparia, Homonoia intermedia, Kaempferia angustifolia, Lippia javanica, Micromelum minutum, Murraya paniculata, Pongamia pinnata, Putranjiva roxburghii, Rotula aquatica, Sensevieria roxburghiana, Terminalia arjuna* and *Zingiber roseum.*

Literature consulted

Anonymous. (2006). State of Environment Orissa. State Pollution Control Board, Orissa.

Biswal, A.K. (1994). Floristic studies in some sanctuaries of Orissa. Ph. D. Thesis.

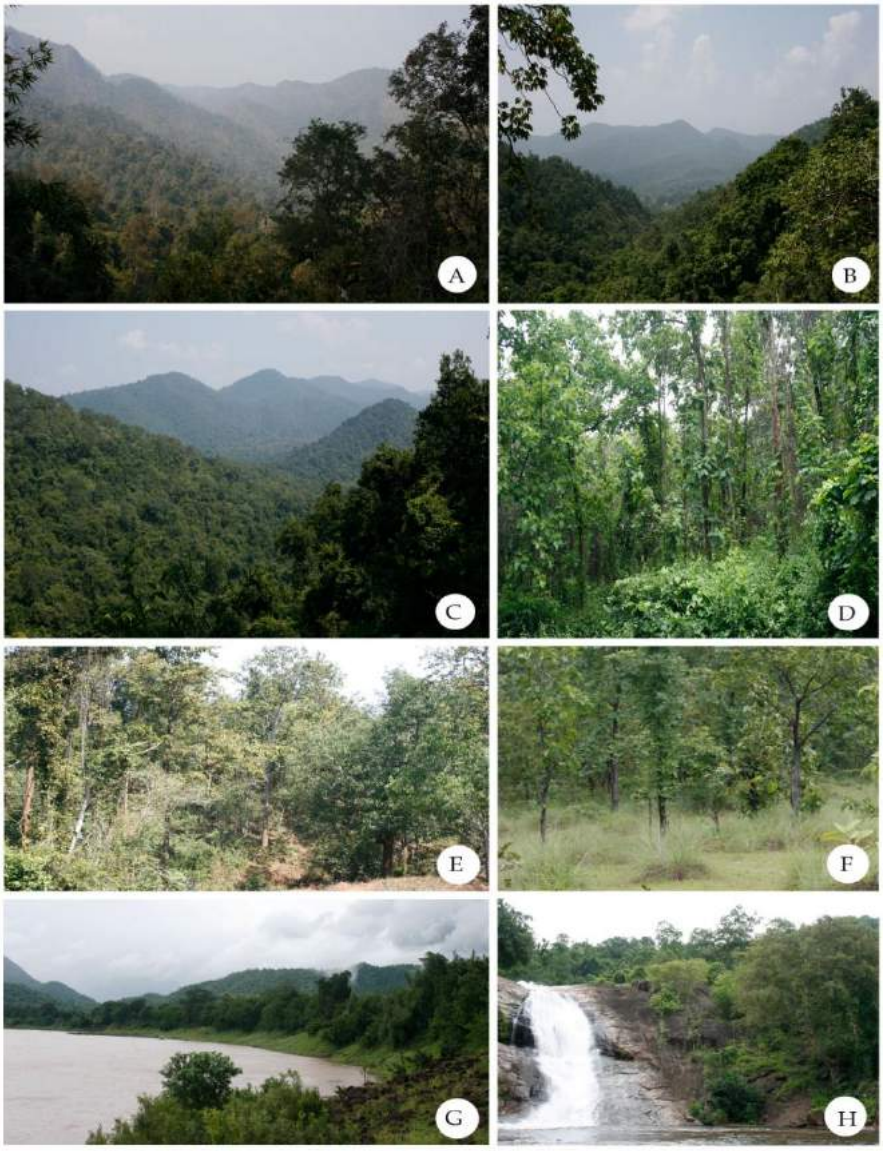


Plate 1. A. Tropical semi evergreen forest; B & C. Moist deciduous forest; D. Sal dominant forest; E & F. Dry deciduous forest; G. Riparian forest along Mahanadi; H. Bheemdhara water fall at Tulka

Champion, H.G. and S.K. Seth. (1968). A Revised survey of the forest types of India. Delhi.

Saxena, H.O. (1976). Floristic studies in Orissa. Bull. Bot. Surv. India 19: 39-41.

Saxena H.O., Brahmam M. (1995). The Flora of Orissa. Bhubaneswar: Orissa Forest Development Corporation Ltd. Vol: 1-4.

Acknowledgement

The authors are thankful to Dr. P. Singh, Director, Botanical Survey of India; permission and logistic support provided by PCCF (WL) and Officials of Odisha State Forest department are gratefully acknowledged.

Blue carbon and its change in dimension due to COP 21

S. Suresh Ramanan
College of Forestry, Kerala Agricultural University
Thrissur, Kerala – 680656.

Introduction

Human beings are one of the species on earth whose actions has greatly led to the increasing levels of the greenhouse gases (GHG) especially through deforestation and improper land use activities, which contribute for 8-20 % of the global emissions (Van der Werf*et al*., 2009). Like Forest ecosystem and trees, there is another ecosystem that has greater potential to sequester carbon. Unfortunately its potential was well known only after evidence indicated that land use change and conversion of this ecosystem contributes to emission of GHG – The coastal ecosystem (Barbier et al., 2011). The carbon stocks of this ecosystem are referred as "Blue Carbon".

Blue Carbon

Carbon stored in mangroves, salt tides marshes and many other live forms including the detrital system is termed as Blue carbon (Mcleod et al., 2011). One of the unique features of this system is its capacity to hold carbon for a greater time periods comparing to that of the terrestrial ecosystem (Duarte et al., 2005; Lo Iacono*et al*., 2008). The main reason for the prolonged storage is the anaerobic condition which is absent in terrestrial ecosystem and much of the carbon stored is oxidized to carbon dioxide (Schlesinger and Lichter, 2001). One of the fine example will be the carbon stocks in coastal sediments and mangroves in Belize which have accreted carbon-rich soils more than 10 meters thick and are more than 6,000 years old (Serrano et al. 2014).

Carbon sequestered can be classified into autochthous or allochthonous (Kennedy et al. 2010). This mainly based on the production and sequestration of the carbon. Blue carbon generally is allochthonousas the site of production and deposition are different as they are constantly battered by waves, tides, and coastal currents that transport sediments and associated organic carbon from adjacent ecosystems (offshore or terrestrial). The plants found in these systems have complex root structures and canopies that are efficient at trapping sediment as it moves through the system.

Table 1: Mean and range values of soil organic carbon stocks

Ecosystem	Carbon Stock Mg/ha	Range Mg/ ha	CO_2/ Mequiv/ ha
Mangroves	386	55-1376	1415
Tidal Salt Marsh	255	16-623	935
Seagrass	108	10-829	396

Source: IPCC 2011

Knowledge gaps

In spite of much greater research and studies carried yet there are greater knowledge gas that need to understand. So there work on this arena is much encouraged. Some of the knowledge gaps are

Geographical extent

While mangroves are fairly well mapped, large areas containing seagrass meadows remain largely unsurveyed, (e.g., Southeast Asia, eastern and western South America and the west coast of Africa). Similarly, the global extent of tidal salt marsh and rates of marsh and seagrass meadow loss are currently un-documented.

Sequestration and storage

Limited data are available in the scientific literature on the carbon sequestration and storage rates of blue carbon ecosystems in Africa, South America, and Southeast Asia.

Emissions and removals

Additional mapping of converted, and degraded and revegetated blue carbon ecosystems and the quantification of emissions from exposed organic soils, and from disturbed or degraded seagrass meadows as well as quantification of removals to restored coastal ecosystems, is needed to enable inclusion in relevant databases (e.g., the IPCC Emission Factor Database).

Human drivers

Emission rates associated with specific human activities over time for various drivers of ecosystem degradation, or loss (e.g., drainage, burning, harvesting, or clearing of vegetation at different intensity levels) are limited at the moment, especially for seagrasses. Removal rates to restored coastal ecosystems are also currently lacking. • Coastal Erosion: A significant amount of eroded coastal carbon is thought to be dissolved in the ocean water where it enters the ocean-atmosphere system. The remaining eroded carbon is deposited in offshore sediments and sequestered. The fate of carbon eroded from blue carbon ecosystems is an ongoing topic of scientific research.

Current trend

According to the Sustainable Development Goals (SDGs) Report, coastal resources are extremely vulnerable to environmental degradation, overäshing, climate change and pollution. Its 14th goal, SDG 14 "Life below water", is to conserve and use the oceans, seas and marine resources for sustainable development. One of the targets of SDG14 is that by 2020 marine and coastal ecosystems should be sustainably managed, protected and restored to achieve healthy and productive oceans. We are not nearly close enough to this target. In contrast, these ecosystems are disappearing rapidly. A new global climate treaty, the Paris Agreement, was adopted in December 2015. Its central aim is to strengthen the global response to the threat of climate change by keeping a global temperature rise this century well below 2 degrees Celsius above pre-industrial levels and to pursue efforts to limit the temperature increase even further to 1.5 degrees Celsius.

Conclusion

In response to the new climate treaty, the International Partnership for Blue Carbon (IPBC) was established at the 2015 Global Landscapes Forum in Paris, France- the biggest side event at COP21. The world has provided a platform for us – the researchers especially to forestry scientist

who have to take up some more steps towards the coastal forests. The momentum to work together to use the opportunities is ripe

References

Barbier, E.B., Hacker, S.D., Kennedy, C., Koch, E.W., Stier, A.C. and Silliman, B.R. (2011). The value of estuarine and coastal ecosystem services. Ecological monographs, 81 (2), pp.169-193.

Duarte, C.M., Middelburg, J.J. and Caraco, N. (2005). Major role of marine vegetation on the oceanic carbon cycle. Biogeosciences, 2(1), pp.1-8.

Hiraishi, T., Krug, T., Tanabe, K., Srivastava, N., Baasansuren, J., Fukuda, M. and Troxler, T.G. (2014). 2013 supplement to the 2006 IPCC guidelines for national greenhouse gas inventories: Wetlands. IPCC, Switzerland.

Kennedy, H., Beggins, J., Duarte, C.M., Fourqurean, J.W., Holmer, M., Marbà, N. and Middelburg, J.J. (2010). Seagrass sediments as a global carbon sink: isotopic constraints. Global Biogeochemical Cycles, 24 (4).

Lo Iacono, C., Mateo, M.A., Gracia, E., Guasch, L., Carbonell, R., Serrano, L., Serrano, O. and Danobeitia, J. (2008). Very high-resolution seismo-acoustic imaging of seagrass meadows (Mediterranean Sea): Implications for carbon sink estimates. Geophysical Research Letters, 35 (18).

Mcleod, E., Chmura, G.L., Bouillon, S., Salm, R., Björk, M., Duarte, C.M., Lovelock, C.E., Schlesinger, W.H. and Silliman, B.R. (2011). A blueprint for blue carbon: toward an improved understanding of the role of vegetated coastal habitats in sequestering CO2. Frontiers in Ecology and the Environment, 9 (10), pp.552-560.

Schlesinger, W.H. and Lichter, J., 2001. Limited carbon storage in soil and litter of experimental forest plots under increased atmospheric CO2. Nature, 411 (6836), pp. 466-469.

Serrano, O., Lavery, P.S., Rozaimi, M. and Mateo, M.Á. (2014). Influence of water depth on the carbon sequestration capacity of seagrasses. Global Biogeochemical Cycles, 28 (9), pp.950-961.

Van der Werf, G.R., Morton, D.C., DeFries, R.S., Olivier, J.G., Kasibhatla, P.S., Jackson, R.B., Collatz, G.J. and Randerson, J.T. (2009). CO2 emissions from forest loss. Nature geoscience, 2 (11), pp.737-738.

मृदा स्वास्थ्य

ममता मेश्राम

वानिकी अनुसंधान एंव मानव संसाधन विकास केन्द्र

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

छिन्दवाड़ा (म.प्र.)

मृदा स्वास्थ्य का आशय मिट्टी की गुणवत्ता के आकलन से है जो पौधे एंव पशुओं की उत्पादकता और विविधता को टिकाऊ रख सके एंव मनुष्यों के स्वास्थ्य में सहायक हो। किसी भी राष्ट्र के वृद्धि एंव विकास में मृदा स्वास्थ्य एक महत्वपूर्ण भूमिका अदा करती है। पौधों के पोषक तत्वों के अंधाधुंध और असतुलित प्रयोग से मृदा स्वास्थ्य में गिरावट के संकेत मिल रहे है। मृदा कार्बनिक कार्बन मृदा स्वास्थ्य के अनुरक्षण में एक महत्वपूर्ण भूमिका अदा करता है परन्तु रासायनिक उर्वरको के बढतें चलन और जमीन में परम्परागत रूप से कार्बनिक पदार्थो को मिलाने का लम्बे समय से अनदेखा किया जा रहा है। संस्थान ने पोषक तत्व प्रबन्ध के क्षेत्र में कई उत्तम विधियों का विकास एंव परीक्षण के साथ-साथ कई महत्वपूर्ण सूचनाओं का भी विकास किया है जिससे विभिन्न मृदा - फसल -जलवायु और प्रबन्ध अवस्थाओं में उत्तम मृदा स्वास्थ्य सुनिश्चित किया जा सके। मृदा स्वास्थ्य में सुधार लाने और उसे बनाए रखने के लिए कुछ उन्नति प्रौद्योगिकियों जैसे कि मृदा परीक्षण के आधार पर लक्षित उपज के लिए पोषक तत्वों का प्रयोग कम भूपरिष्करण एंव लाभकारी सूक्ष्मजीवों का प्रयोग एंव समन्वित पौध पोषण प्रणाली का प्रयोग करना आदि है ।

पोषक तत्वों के स्त्रोत के रूप में केवल उर्वरकों के प्रयोग के सहारे उत्पादकता और लाभ के रूप मे कृषि उत्पादन प्रणाली को टिकाऊ नहीं बनाया जा सकता है। दूसरी तरफ समन्वित पोषक तत्व प्रबन्धन तकनीक एक जानी मानी पहचानी तकनीक है और वर्तमान समय में कासनों का रूझान इस ओर हुआ है। समन्वित पोषक तत्व प्रबन्धन तकनीक में रासायनिक, कार्बनिक और जैविक उर्वरकों के रूप में पोषक तत्व की पर्याप्त एंव संतुलित मात्रा को समन्वित रूप में प्रयोग करते है। इस प्रणाली को अपनाने से पोषक तत्व उपयोग दक्षता में बढ़ोत्तरी, मृदा स्वास्थ्य को बरकरार रहने के साथ उपज में बढ़ोत्तरी होती है और लागत में कमी आती है। समन्वित पौध पोषक तत्व प्रबन्धन तकनीक से अभिप्राय है कि मृदा उर्वरता को बढ़ाने अथवा बनाए रखने के लिए पादप पोषक तत्वों के सभी उपलब्ध स्त्रोतों से मृदा में पोषक तत्वों का इस प्रकार से सामंजस्य रखा जाये जिससे मृदा की भौतिक, रासायनिक और जैविक गुणवत्ताओं पर हानिकारक प्रभाव डाले बगैर लगातार उच्च

आर्थिक उत्पादन लिया जा सके । समन्वित पौध पोषक प्रणाली में रासायनिक उर्वरको के साथ कार्बनिक खादें जैसे गोबर की खाद, कम्पोस्ट, हरी खादें, फसल अवशेष तथा दलहनी फसले व जैव उर्वरकों इस तरह से उपयोग से है जिससे मृदा स्वास्थ्य तथा पर्यावरण पर बगैर हानि पहुचाये लगातार कृषि उत्पादन लिया जा सके एंव प्रबंधन इस प्रकार से होना चाहिए कि किसी भी फसल चक्र प्रणाली में फसल की आवश्यकतानुसार पोषक तत्वों का संतुलित एंव इष्टतम् मात्रा में आपूर्ति का सामंजस्य हो ।

हमारी मृदा हजारों सालों से ये पोषक तत्व पौधों को प्रदान कर रही है लेकिन अब पौधों द्वारा पोषक तत्वों का लगातार शोषण एंव इनकी आपूर्ति में कमी होने से मृदाओं में इन तत्वों की कमी हो गई है। ईधन एंव चारे के रूप में प्रयोग होने से कार्बनिक खादों की उपलब्धता भी एक समस्या है। पौधों की वृद्धि एंव विकास के लिए कार्बन, हाइड्रोजन, अक्सीजन, नाइट्रोजन, फॉस्फोरस, पोटेशियम, कैल्शियम, मैग्नीशियम तथा गंधक की पौधों को अधिक मात्रा में आवश्यकता होती है अतः इन्हे मुख्य पोषक तत्व कहते है जस्ता, लोहा, मैगनीज, तांबा, बोरोन, मोलिब्डेनम, क्लोरिन तथा निकिल की पौधों को कम मात्रा में आवश्यकता होती है अतः इन्हे सुक्ष्म पोषक तत्व के नाम से जाना जाता है। मृदा सुक्ष्म पोषक तत्वों का प्राथमिक स्त्रोत है जो कि पौधों, जानवरों एंव मनुष्यों के स्वास्थ्य के लिए आवश्यक है। जमीन में पोषक तत्वों की कमी मनुष्यों एंव पशुओं में कुपोषण एंव स्वास्थ्य संबंधी समस्यायें पैदा हो रही हैं । पोषक तत्व के अपर्याप्त एंव असंतुलित प्रयोग से लाभ की अपेक्षा नुकसान अधिक हुआ है। जमीन में सुक्ष्म एंव द्वितीयक पोषक तत्व जैसे जस्ता, लोहा, तॉबा, मैगनीज और कोबाल्ट की कमियॉ उभर कर सामने आयी हैं। जस्ता की कमी वाली मृदाओं में उगने वाली फसलों मे सामान्यतया जस्ता की मात्रा की कमी होती है और वहॉ पर जस्ता से सम्बंधित स्वास्थ्य संबंधी समस्यायें अधिक होने की संभावना होती है ।

भारत एक मृदा, फसल एंव जलवायु विविधता वाला देश है । ऐसी परिस्थिती में टिकाऊ कृषि उत्पादकता प्राप्त करना पोषक तत्वों के जगह विशेष प्रबंध पर निर्भर करती है। वह उर्वरक उत्पादन एंव कृषि विधियों जो पोषक तत्वों की उपयोग दक्षता में वृद्धि कर सके, किसानों के बीच लोकप्रिय होनी चाहिए। कार्बनिक खादों के कम प्रयोग के साथ उर्वरकों के असंतुलित प्रयोग, मृदा स्वास्थ्य का खराब होना, फसलों की गिरती उत्पादकता और गिरती उर्वरक अनुक्रिया के लिए प्रमुख उत्तरदायी है। इस प्रकार भारतीय मृदाओं पोषक तत्वों के अनुचित प्रबंध के कारण बहु पोषक तत्वों की कमियॉ उभर कर सामने आई। आजकल बलुई मृदाओं में धान के बाद गेहु और रबी चारा उगाने से मैगनीज की कमी देखी गई। सन् 1990 के प्रारम्भ में 130 जिलों में गन्धक

की कमी थी जो अब बढकर 240 जिलों तक पहुच गई। (स्त्रोतः ए.के.त्रिपाठी एंव ए.बी.सिंह, भारतीय मृदा विज्ञान संस्थान,भोपाल). भारत में 49 प्रतिशत मृदाओं में जस्ता, 12 प्रतिशत में लोहा, 5 प्रतिशत में तांबा तथा 4 प्रतिशत मृदाओं में मैगनीज की कमी है। जिनका प्रभाव फसलों की उपज पर भी पड़ रहा है। दलहन, तिलहन, तथा अधिक उपज देने वाली फसलों में गन्धक का प्रयोंग जरूरी हो गया हैं यह तिलहनी फसलों में तेल बनाने में महत्वपूर्ण है। यह फलीदार पौधों में ग्रंथियॉ बनाने के लिए आवश्यक होता है। गन्धक की कमी से पुरानी के बजाय नई पत्तियॉ पीली पड़ने लगती है।तथा कुछ पौधों में फल नहीं लगते है।

किसी भी मिट्टी की उर्वरता तथा पोषक तत्व पौधों को पर्याप्त मात्रा में उपलब्धता तब होती है जब सूक्ष्मजीवों की सख्या तथा उनके द्वारा एंजाइम मिट्टी में अधिक से अधिक मात्रा में उपलब्ध हो। तभी मृदाओं में जैविक गतिविधियॉ सुचारू रूप से कार्य करती है इसलिए ये मृदायें अधिक उपजाऊ होती है। नाइट्रोजन, फॉस्फोरस, पोटाश के अलावा गंधक, जिंक व बोरॉन की कमी मिट्टी में आ रही है। हॉलाकि गंधक एसएसपी जैसे उर्वरकों में पाया जाता है। पौधों को फॉस्फोरस की कमी न हो इसका इसका ख्याल रखने की जरूरत होती है। क्योंकि अधिकांश खादों में फॉस्फोरस की मात्रा कम होती है। भुमि में जैविक खादों का काफी मात्रा में उपयोग करना चाहिए। खासकर अम्लीय मृदाओं में जैविक खेती करते वक्त रॉक फास्फेट का उपयोग आवश्यक रूप से करना चाहिए। क्योंकि अम्लीय वातावरण में इसकी धुलनशीलता बढ़ जाती है। इसके साथ कोई भी जैविक खाद बनाते समय रॉक फास्फेट को मिलाते रहने से भी जैविक खाद की गुणवता बढ़ाई जा सकती है। विभिन्न पोषक तत्वों की कमी को पूरा करने के लिए खादों का प्रयोग अनिवार्य हो जाता है। खादों के अतिक्ति जैविक खेती करते समय अन्य बाते भी जरूरी है। जैसे फसल चक्र में बदलाव, मिश्रित खेती, दलहनी फसलों का समावेश, दलहनी फसलों में राइजाबियम कल्चर का प्रयोग इत्यादि.

विभिन्न विधियों द्वारा निर्मित खाद जैसे फसलों के अवशेष, हरी खाद, व विभिन्न जैविक खादों जैसे कुकुट खाद, केचुआ खाद, शहरी खाद, जानवरों मल-मूत्र से निर्मित खाद इत्यादि में गौण व सूक्ष्म पोषक तत्व भी उपलब्ध रहते है। इसलिए प्रमुख पोषक तत्वों की पूर्ति के समय गौण व सूक्ष्म पोषक तत्व भी फसलों को मिल जाते है। प्रयोगों से पाया गया कि असुंलित मात्रा में पोषक तत्व डालने से उत्पादकता में कमी हो गयी। अगर किसान भाई केवल युरिया (नत्रजन), एसएसपी (फॉस्फोरस) का प्रयोग सालों साल करते रहने से फसल के उत्पादन में निश्चित तौर पर गिरावट आयेगी। इस गिरावट के कारण मृदा का प्रकार, मिट्टी में आयी पोषक व सूक्ष्म पोषक तत्वों की कमी तथा मृदा का pH मान में गिरावट

इत्यादि माने जाते है। इसलिए भाइयों से निवेदन है कि मृदा की जॉच समय-समय पर यानी 3-5 वर्षा के अंतराल से अवश्य करें ।

Present and future scenario of farmer's income

Vikas Kumar
College of Forestry, Kerala Agricultural University (KAU),
Thrissur, Kerala-680656

Due to urbanization and population explosion, there is a continuous decline in the availability of cultivated land (Kumar, 2017). India is bestowed with varied agroclimatic conditions, which favour the cultivation of temperate, tropical, subtropical and arid zone fruits. The vast chunk of Indian population residing in rural area (68.84 %), out of which 57.57 % still depend on agriculture. Therefore, India's development is intimately linked with rural development through improve the income of farmers. Interestingly, the data trend also showed that increasing in area (4.01 to 7.21 million), production (43.0 to 88.97 million tonnes) and productivity (10.70 to 12.30 t ha^{-1}) of fruit crops during 2001 to 2015. The cultivation of agricultural crops is not easy task due to various factors such as climate change, shrinking land and water resources, high input and labour cost, uncertainties in market prices, highly perishable nature of fruits and it also due to climatic, edaphic and biotic adversities and fluctuations. The following points may increase incomes of farmer's by improving productivity such as

- Biotechnology for improving productivity
- Subsidy provide to farmers specially in micro-irrigation, farm mechanization and fertilizer
- Increased budget on farmer's inter-state exposure visits and training scheme of MoA.
- Integrated farming system (IFS) such as horticulture, fisheries, dairy, poultry, etc.
- Promote the agroforestry based system (Kumar, 2016).
- Regular interval checks the soil fertility status.
- Effective pests and disease management.
- Focus on post harvesting management and value addition products.
- Promote the sustainable development model (Kumar and Tripathi, 2016).

July 12, 2016 the honorable Prime Minister Mr. Narendra Modi expressed the government's desire to double farmer's income by 2022 while addressing on 34 th foundation day celebration of National Bank for Agriculture and Rural Development's (NABARD). He also listed his seven strategies such as (i). Big focus on irrigation with large budgets, with the aim of "per drop, more crops; (ii). Provision of quality seeds and nutrients based on soil health of each field; (iii). Large investments in warehousing and cold chains to prevent post-harvest crop losses; (iv). Promotion of value addition through food processing; (v). Creation of a national farm market, removing distortions and e-platform across 585 stations; (vi). Introduction of a new crop insurance scheme to mitigate risks at affordable cost; and (vii). Promotion of ancillary activities like poultry, beekeeping and fisheries.Of these, strategies (i) and (ii) address the

farm level production related issues and7th addresses the issue of augmenting income through off-farm andnon-farm activities. More strategies need to be built around natural resource management, social sector policies such as health and education.The heavy downpour of commentaries and opinions came from several economists and columnists in different fora has examined the major constraints for doubling of income are low Minimum Support Price (MSP), non-remunerative price in the market, low share offarmers in final price, poor penetration of crop insurance, high and increasing input cost, absence of market infrastructure and past record of modest growth compared to 12 per cent needed for doubling in nominal terms (20 to 30 % in real terms. Swaminathan (2016) has suggested five steps for doubling income such as (1). Enhance small farm productivity andstability of production through soil health care, water harvesting and management, choice of appropriate technology and inputs, credit and insurance and finally opportunities for remunerative and assured marketing; (2). Focus on the knowledge, skill, and credit and land ownership empowerment of women farmers; (3). Include high valuecrops, horticulture, animal husbandry, agro-forestry in the farming systems; (4). Promote commercial use of the whole biomass of the crop; and (5). Fix the procurement price at cost C2 plus 50 per cent toenable small farmers enough surpluses.

References

Swaminathan, MS (2016): How to double farmers' income, March 23. http://goo.gl/gFTG1E.

Kumar, V. (2017). Agrobiodiversity, Structural Compositions and Species Utilization of Homegardens in Humid Tropics, Kerala, India. PLO Sone (In press).

Kumar, V. and Tripathi, A.M. (2016). Vegetation composition and functional changes of tropical homegardens: Prospects and challenges. In: Gupta, S.K., Panwar, P. and Kaushal, R. (Eds), Agroforestry for increased production and livelihood security, NIPA, New Delhi, pp 473-505.

Kumar, V. (2016). Multifunctional Agroforestry Systems in Tropics Region. Nature Environment and Pollution Technology 15 (2): 365-376

सोनापाठा (ओरोजाइलम इंडिकम)– एक पवित्र एवं चमत्कारी औषधीय पादप

विनीत सिंह[1] एवं राजीव कुमार सिंह[2]

[1]भारतीय वनस्पति सर्वेक्षण, मध्य क्षेत्रीय केंद्र, इलाहाबाद (उत्तर प्रदेश) - 211 002

[2]भारतीय वनस्पति सर्वेक्षण, दक्षिणी क्षेत्रीय केंद्र, कोयम्बटूर (तमिलनाडु) - 641 003

वनस्पतिक वर्गीकरण

जगत- प्लांटी , वर्ग- मान्नोंलियोफाइटा , कुल- बिग्नोनिएसी, प्रजाति- ओरोजाइलम , जाति- इंडिकम

भौगोलिक वितरण

बौद्ध धर्म में अति-पवित्र और औषधीय दृष्टि से अति महत्वपूर्ण यह वृक्ष प्राकृतिक रूप से भारत के सभी राज्यों में पाये जाने के साथ ही वनस्पतिक औषधीय उपवनों में भी लगाया जाता है । लेकिन जहां भी यह वृक्ष पाया जाता है , इसकी संख्या संकुचित होती है।

भारत में यह हिमालय से लेकर दक्षिण भाग कोंकण, मालाबार और कोरोमंडल तट तक इसके अलावा आंध्रप्रदेश के सघन वनों में पाया जाता है। विश्वस्तर पर थाईलैंड , श्रीलंका , फिलीपींस , इंडोनेशिया, चीन, म्यांमार, कंबोडिया, होन्डुरस, लाओस, नेपाल , ताइवान , विएतनाम , भूटान , एवं मलेशिया , में मुख्य रूप से सदाबहार , पर्णपाती एवं मिश्रित वनों में समुद्र ताल से 2300-2900 फीट की ऊंचाई तक पाया जाता है।

इस वृक्ष को संस्कृत में श्योनाक , हिन्दी में साओना, सोनापाठा , अरलू , बंगाली में सोना , नसोना, मराठी में टेटू , गुजराती में आरलू , तेलुगू में डुनडिलम , तमिल में आची , कन्नड़ में तिगड़ू , मलयालम में जल-गापाइयानी , उड़िया में फापनी, पंजाबी में मूलिन, टाट मोरंग, असमिया में टोगुना , भटघिला , नेपाली एवं लेपचा में टटोला एवं अँग्रेजी में इंडियन ट्रमफेड , मिडनाइट हॉरर आदि नामों से जाना जाता है।

पादप वर्णन

यह बिग्नोनिएसी कुल एक मध्यम आकार का पतझड़ी वृक्ष है । जिसकी ऊंचाई लगभग 10-12 मी॰ तक होती है । इसकी छाल खुरदुरी एवं हल्के पीत-भूरे रंग की होती है । ये वस्तुतः वनों के किनारे, खड्डो और नमी युक्त क्षेत्रों में पाया जाता है। इसकी संयुक्त पत्तियाँ लगभग एक मीटर तक लंबी, त्रिकविन्यासी , द्विपिच्छकी , प्रतिमुखी कर्णपाली, पर्णक अंडाकार या दीर्घवृत्ताकार, पुष्प खड़े, बड़े असीमांक्षों पर जामुनी एवं पीत रंग के अग्रीव मंजरियों से मांसलयुक्त होते हैं । इसकी फली लंबी तलवार नुमा , छपती 70 सेंटीमीटर लंबी एवं 10 सेंटीमीटर चौड़ी एवं कठोर होती है । कपाट काष्ठीय , किनारों के तरफ मुड़े हुये और बहुबीजी होते हैं ।

परागण एवं संवर्धन संबन्धित महत्वपूर्ण तथ्य

भारतीय वनस्पति सर्वेक्षण , मध्य क्षेत्रीय केंद्र में इसके परागण एवं जड़ीय कल्लों से इसके संवर्धन के बारे में अध्ययन किया गया । इसका पुष्प रात्रि में 7:00 से 8:00 बजे के आसपास खिलने लगता है एवं प्रातः 4:30 तो 5:30 बजे के मध्य गिर जाता है । इसमें परागण की प्रक्रिया केव नेकटर चमगादड़ (इयोनीकटेरिस स्पेलिया) द्वारा संपन्न की जाती है । साथ ही इस वृक्ष के जड़ों के आस-पास की मृदा में एक्टिनोमाइसिटिज ग्रुप का एक

कवकीय सदस्य (स्वीडोकोनिडिया ओरोजाइली) पाया जाता है । प्राकृतिक रूप में यह वृक्ष बीजों से उत्पन्न होता है , वे वर्षा ऋतु के आरंभ में अंकुरित होते है। इसके बढ़ने के लिए थोड़ी नमी एवं छाया की आवश्यकता होती है । इसके साथ ही जड़ीय कल्लों को रोप कर भी लगाया जा सकता है । ये कल्ले बहुतायत से उत्पन्न होते हैं और जनक तने के चारों ओर घनी झाड़ी सी संरचना बना लेते हैं। कल्लों से लगाए गए पौधों में एक वर्षा के उपरांत ही पुष्प और फल आने लगते हैं । इनसे प्राप्त वृक्षों की लंबाई एवं मोटाई बहुत तेजी से बढ़ती है।

रासायनिक संघटक

किसी भी पौधे की औषधीय गुणवत्ता उसमें पाये जाने वाले माध्यमिक चयापचयों (सेक्रेन्डरी मेटाबोलाइट्स) के आधार पर होती है । इस वृक्ष के तने एवं जड़ की छाल में तीन फ़्लवोन रंजक पदार्थ – ओरोक्स्यलेने- ए , बाइकैलेयीन और क्राइसिन पाये जाते हैं। तने की छाल में एक अल्कलोइड्स का रंच , टैनिक अम्ल , सीटोस्टेरोल और गलक्टोस भी पाये जाते हैं।

इसके बीजों को पैट्रोलियम ईथर से निष्काषित करने पर लगभग 20 प्रतिशत तक सूखने वाला एक चटक सुनहरा तेल प्राप्त होता है । बींजों में एक पीला क्रिस्टलित पदार्थ और बाइकाइलेन अल्कलोइड्स पाया जाता है जो इसका ग्लूकोसाइड टेटुइन (बाइकाइलेन-6- ग्लूकोसाइड) होता है।

हाल ही में इसके बीजों में पाये जाने वाले बाइकाइलेन रासायनिक के आधार पर इसमें मधुमेह से लड़ने की क्षमता का पता लगाया जा रहा है।

परंपरागत औषधीय एवं आर्थिक उपयोग

परंपरागत औषधीय महत्व

यह वृक्ष अपने औषधीय गुणों के कारण सम्पूर्ण दक्षिणी-पूर्व एशिया में प्रसिद्ध है। इसका प्रत्येक भाग पुरातन कल से मानव जीवन में होने वाली अनेक व्याधियों के समाधान में उपयोग हो रहा है। भारतवर्ष में उपयोग होने वाली अनेक आयुर्वेदिक औषधियों में इसका कोई न कोई भाग एक प्रमुख संघटक के रूप में प्रयुक्त होता है। जैसे- च्यवनप्राश (बीज एवं तने की छाल) , दशमूलारिष्ट (जड़) , महानारायण तेल (जड़) , दशमूल अमृतारिष्ट (जड़) , कुमकुमआदितेलम आदि अतिलाभकारी औषधियों में प्रयुक्त होता है। इस वृक्ष के अधिकतर भाग भेषज के रूप में उपयोग किए जाते हैं। इसके जड़ की छाल आयुर्वेदिक चिकित्सा प्रणाली में सुपरिचित है एवं ताजी छाल अनेक रोगों में लाभकारी है । यह गंधहीन, रंग में हल्की पीली से धूमिलाभ तक , मुलायम एवं रसीली होती है । स्वाद की दृष्टि से यह शुरुआत में मीठा और बाद में कसैला हो जाता है । तने की छाल कम रसीली एवं मीठी तथा अधिक चर्मिल एवं चीमड़ होती है । कभी-कभी इस पादप की पूरी जड़ उपयोग में लाई जाती है जो कम असरदार होती है।

जड़ की छाल कसैली होती है जो टॉनिक के रूप में प्रवाहिका तथा पेचिस में दी जाती है । यह स्वेदकारी और गठिया बाई में उबालकर एवं कर्णश्राव में उपयोग किया जाता है । इसके कोमल फल ताजगीदायक और क्षुधावर्धक एवं बीज विरेचक होते हैं । मलाया में इसकी पत्तियों का क्वाथ पेटदर्द , गठिया रोग , बढ़ी हुई तिल्ली , सिरदर्द, और फुंसियों को ठीक करने में प्रयुक्त किया जाता है । इसके मूल छाल का उपयोग आमवत, अतिसार, कास, ज्वर, बवासीर, मिर्गी, के रोगी को इसकी छाल चूर्ण दूध के साथ सेवन करने से लाभ मिलता है । इसका छाल का उपयोग मूत्र रोगों में भी किया जाता है।

साथ ही जिन महिलाओं को प्रसूति जन्य रोग है एवं बच्चा होने के बाद यकृत की समस्या या सूजन

छायाचित्र : ओरोजाइलम इंडिकम का वृक्ष (फल के साथ) पुष्प एवं पुष्पगुच्छ।

हो जाती है , उनके लिए इसके तने की छाल को गुड के पानी में पकाकर प्रातः काल पीने से आराम मिलता है। खांसी की समस्या के लिए इसकी सुखी छाल का पाउडर , सोंठ एवं शहद के साथ लेने से अतिशीघ्र फायदा मिलता है । इसकी छाल में निहित सोडियम सेलिसिलेट की प्रचुर मात्रा संधिवात रोगों का समन करती है । तने की छाल का लेप जानवरों के घाव पर लगाया जाता है ।

परंपरागत आर्थिक उपयोग

औषधीय महत्व के साथ-साथ इस पादप का आर्थिक रूप से भी बहुत महत्व है । इसकी नई कोपलें और कच्चे फल सब्जी की भाँति उपयोग किए जाते हैं । हिमालयी क्षेत्रों में पाये जाने वाले आदिवासी इसके पुष्प एवं छाल को भी खाते हैं । इसकी टहनियों का उपयोग पशुओं के चारे के रूप में किया जाता है । इसके पतले हल्के बीज टोपों और छतरियों में भरने के काम में लाये जाते हैं । छाल और फल रंगाई एवं कढ़ाई में रंग स्थापक की भाँति उपयोग किए जाते हैं । इसकी लकड़ी पीताभ श्वेत और मुलायम होती है , जो ईधन के रूप में प्रयुक्त की जाती है । फिलीपीन्स में इसकी लकड़ी से दियासलाई की डिब्बियाँ बनाई जाती हैं ।

पादप संरक्षण स्थिति

आज के इस आधुनिक परिवेश में औषधीय एवं आर्थिक गुणों से परिपूर्ण इस वृक्ष के प्रत्येक भाग का दोहन अत्याधिक मात्रा में हो रहा है । जिसके कारण इसकी संख्या दिनोदिन घटती जा रही है । भारत के कई राज्यों जैसे कर्नाटक , आंध्रप्रदेश , महाराष्ट्र आदि में यह संकटग्रस्त श्रेणी में आ गया है । इसके लिए हमें उत्पादन एवं पूर्ति में संतुलन स्थापित करना अत्यंत आवश्यक है , जिसे इसके अनुकूल जलवायु वाले स्थानों में बढ़ाया जा सकता है । साथ ही इस वृक्ष को इसके प्राकृतिक आवास में भी संरक्षित किया जाना चाहिए , जिससे ऐसे महत्वपूर्ण पादप इस धरा पर चिरकाल तक फलते- फूलते रहें ।

संदर्भ

Anonymous (1966). The Wealth of India, Raw Materials. Publications and Information Directorate, CSIR, New Delhi, VII: 107-108.

Kirtikar, K.R. and Basu, D.D (2001). Indian Medicinal Plants. Oriental Enterprises, Dehradun, IV: 1105-1107.

Singh, V. and Singh, R.K. (2014). Ex-situ conservation of *Oroxylum indicum* (L.) Kurz, using root suckers at experimental garden, Botanical Surveu of India, Central Regional Centre, Allahabad. Biohearld, 4(2): 56-58.

Exotic tropical fruit trees and their utility

Charana Kumar and R. Vasudeva
Department of Forest Biology and Tree Improvement
College of Forestry Sirsi, UAS, Dharwad.

Introduction

The introduction of exotic tropical fruit trees has been so important in the developing countries. Tropical Fruit Trees (TFTs) genetic resources are components of agro-ecosystems and natural forests of Kodagu, one of the worlds' natural heritage sites. Tropical Fruit Tree (TFT) species are intricately associated with the culture of peoples, their livelihoods and food security in South, Southeast and East Asia. A rich diversity of over 500 species of TFT, of which about 90% are perennial, found in this region provide for a broad range of livelihood options to local people in the form of food supplements, better nutrition, household income and employment (Bhagmal *et al*., 2011). TFT species are also found commonly in home-gardens and planted around home-gardens as well as in farmlands. As various analyses and summary reports have repeatedly indicated (Kumar and Nair, 2004), food plants (food crops and fruit trees) are the most common species in most home-gardens throughout the world.

Materials and methods

Study area

The study was conducted in Kodagu district. Kodagu district is part of Central Western Ghats one of the 8 Hottest hot spots of biodiversity in the world. The district is one of the largest wooded regions in the country with 80% of the land area under tree cover which includes coffee based agroforestry systems. The GPS co-ordinates of Kodagu district is Elevation is 1000 MSL, Latitude: $12^{0}26$ N and Longitude: $75^{0}57$ E. The forest types include evergreen, semi evergreen, moist deciduous and dry decidious types. Sacred forests are the unique biodiversity indicators managed by local peoples through worshiping deities inside the forest.

Survey

Survey was conducted in nine villages of Kodagu district. Villages are selected based on representation of three levels of rainfall and associated forest type, was done using structured questionnaire to collect data on the species, varieties of traditional fruit tree grown in home gardens as well as their utility and threats. In every village data from about 10 to 25 households were collected. Field observations and specimen collection were to identify the species and varieties. The questionnaire included details on general information of the family, major production system, details of the land holdings, details of the TFT species and their utilization etc.

Results

A stunning diversity of 16 exotic Tropical Fruit Tree species was recorded from home gardens and agroforestry systems of Kodagu. Citrus varities are the distributed abundantly in all villages, while Bilimbi, Tamarind occurred rarely. Many species of *Citrus* species traditionally managed in coffee agro-ecosystems also in home gardens and utilized to prepare various products by local people are relatively well

Sl no.	Common name	Scientific name	Family	Exotic /Native	Production system	Major use
01	Parangi	*Carica papaya* L.	Caricaceae	Exotic	Home garden	Fruits are edible and used to make squash
02	Bilimbi	*Averrhoa bilimbi* L.	Oxalidaceae	Exotic	Home garden	Used to make pickle
03	Geru	*Anacardium occidentale* L.	Anacardiaceae	Exotic	Home garden	Fruits are edible and used to make wine
04	Sapota	*Achras zapota* (L.) P. Royen	Sapotaceae	Exotic	Home gardens, Scattered planting in estate and plantation	Fruits are edible and used to make squash
05	Ramphala	*Annona squamosa* L.	Annonaceae	Exotic	Home garden	Fruits are edible
06	Sitaphala	*Annona reticulate* L.	Annonaceae	Exotic	Home garden	Fruits are edible
07	Guava	*Psidium guajava* L.	Myrtaceae	Exotic	Home garden	Fruits are edible, used to make squash and juice
08	Hybrid nerale	*Syzygium aquam*	Myrtaceae	Exotic	Home garden	Fruits are edible
09	Jambu nerale	*Syzygium jambos* (L.) Alston	Myrtaceae	Exotic	Home garden	Fruits are edible
10	Dalimbe	*Punica granatum* L.	Punicaceae	Exotic	Home garden	Fruits are edible
11	Malayan apple	*Syzygium samarangense*	Myrtaceae	Exotic	Home garden	Fruits are edible
12	Singapoor cherry	Muntingia calabura L.	Muntingiaceae	Exotic	Home garden	Fruits are edible
13	Bread fruit	*Artocarpus incisa* L.	Moraceaae	Exotic	Home garden	
14	Common fig	*Ficus carica* L.	Moraceae	Exotic	Boundary planting	Fruits are edible
15	Elli	*Citrus reticulata* Blanco	Rutaceae	Exotic	Home garden	Fruits are used for to make pickles, juice.
16	Rambutan	*Nephelium lappaceum L.*	Sapindaceae	Exotic	Home garden	Fruits are edible

conserved. Rambutan is one of the newly introduced TFT in the district and the farmers are having curiosity to grow this tree because of its taste, economic value and adoptability to the climate.

References

Charana Kumar., Jadeyegowda. M., Ramesh. M. N., Vasudeva. R. and Ashwath. M. N. (2015). Tropical Fruit Tree Genetic Resources in Coffee-based Landscapes of Kodagu: Diversity and On-farm Conservation International Journal of

Basic and Applied Sciences Vol. 4. No. 4 2015. Pp. 221-224

Ogbu, J. U., Essien, B. A., Essien, J. B. and Anaele, M. U., (2010) Conservation and management of genetic resources of horticultural crops in Nigeria: Issues and biotechnological strategies. Journal of Horticulture and Forestry Vol. 2(9) pp. 214-222

Dawson, Ian K., Lengkeek, Ard., John, C. and Weber Ramni Jamnadass. (2008). Managing genetic variation in tropical trees: linking knowledge with action in agroforestry ecosystems for improved conservation and enhanced livelihoods. Biodivers Conservation 18:969–986.

Dinesh M.R, Vasudeva R, Shailendra Rajan, Sanjay Kumar Singh, Singh I.P, Gajanana T.M, Vinoth S, Reddy BMC, Parthasarathy V.A and Bhuvan sthapit. (2014). Custodians of Tropical Fruit Genetic Resources in India National Project Management Unit UNEP/GEP project, Indian Institute of Horticultural Research, Hesaraghatta lake post, Banglore.

Leakey, R.R.B., Last, F.T., and Longman, K.A. (1982). Domesticatio of tropical trees: an aproach securing future productivity and diversity in managed ecosystems. Commw. For. Rev. 61(1), PP 33-42.

Sthapit, B.R., Ramanatha, Rao V., Sthapit, S.R., (2012). Tropical Fruit Tree Species and Climate Change. Bioversity International, New Delhi, India.

Painting, K.A., Perry M.C., Denning R.A. and Ayad W.G. (1995). Guide book for genetic resources documentation, International Plant Genetic Resources Institute, Rome.

Lowe, A . J ., gillies, A. C. M., Wilson, J. and Dawson, I.K. (2000). Conservation genetics of bush mango from central/west Africa: implications from random amplified polymorphic DNA analysis. Molecular Ecology, pp 831–841

Maria do Socorro Moura RUFINO., Ricardo Elesbao ALVES., Edy Sousa de BRITO., Marcia Ragia Souza da SILVEIRA. and Carlos Farley Herbster MOURA. (2009) Quality for fres consumption and processing of some non-traditional tropical fruits from Brazil. vol. 64, pp. 361–370

Jamadon, B., Zulhailaril, A. and Shukor, Mohd. N. (2007). Current status of conservation and utilization of tropical plant genetic resources for food and agriculture in Malaysia. International training-workshop, conservation and utilization of tropical/subtropical plant genetic resources.pp 51-56.

Vasudeva, R. and N Rajeshwari, N. (2014) Appemidi: Wild Aromatic Pickle Mango of the Central Western Ghats. India. Information Brochure, UNEP / GEF project on Tropical Fruit Trees.

Vasudeva, R., Abebe, A.A., Hegde, N.R. and Deepa, G.S. (2011) Documenting fruit trait diversity of aromatic pickle mango in the humid tropics of central Western Ghats. In: Proc. of 'Augmenting Production and Utilization of Mango: Biotic and Abiotic Stresses' organized by the Society for Development of Subtropical Horticulture, Central Institute for Subtropical Horticulture (ICAR), Lucknow.

Beaumont LJ, A Pitman, S Perkins, NE Zimmermann, NG Yoccoz and W Thuiller (2011) Impacts of climate change on the world's most exceptional eco-regions. *Proc.* Natl. Acad. Sci. *U S A* 108: 2306–2311.

Bhagmal V., V Ramnatha Rao, RK Arora, PE Sajise and Bhuwon Sthapit (2011) Conservation and sustainable use of tropical fruit species diversity: Bioversity's efforts in Asia, the Pacific and Oceania. *Indian J. Plant Gen. Res.* 24: 1-22.

Lichens as air pollution bio-indicators

P. Shiva Kumar Singh[1] and D.S.R. Rajender Singh[2]
[1]Department of Botany, Palamuru University, Mahabubnagr-509001, Telangana
[2]Sri Venkateshwara Government UG & PG College, Palem, Nagarkarnol, Telangana

Abstract
In the present article the fundamentals, importance of lichens have been discussed. Lichens are mutualistic associations of a fungus and an alga or cyanobacterium and occur as crusty patches or bushy growths on trees, rocks and bare ground. The names given to lichens strictly refer to the fungal partner; the algae have separate names. Lichens are very sensitive to sulphur dioxide pollution in the air. Since industrialization, many lichen species have become extinct in large areas of lowland Britain. The effect of Sulphur dioxide in the growth of lichens, the interaction and mode of action of lichens against Sulphur dioxide mentioned.

Introduction
Lichen is an accompanying organism: two very different beings, an alga and a fungus, live together in a qualified symbiotic association, producing a new body, or lichen thallus. Much of the lichen body is a tangle of fungal filaments called hyphae; these filaments clasp alga, sometimes in a mat, or sometimes wrapped as single cells. The fungus collects water and provides structure and protection for the alga, and may in certain species extract minerals for both organisms from the substrate. The alga possesses chloroplasts and can photosynthesize, thus providing carbohydrates for both itself and its fungal partner.

When a fungus joins with an alga, it is said to be "lichenized." Many scientists, consulting a family tree of DNA, now believe that different forms of lichens evolved in independent strands of fungi development. They do not agree on the number of strands.

Lichens have special adaptations which permit them to withstand extremes of moisture and temperature. When moisture is available, it is taken up by the fungus leading to a mechanical change which allows lighter to get through, triggering algal photosynthesis; new food and new tissue are then made. When the atmosphere is dry, however, the lichen is dormant and does not grow.

Because lichens are hardy, love light, live a long time, and grow slowly, they can be pioneers in many inhospitable environments such as tundra, exposed rock surfaces, asbestos, mortar, tropical leaf surfaces, and even in water. When they decay, their nutrients nourish new settlers such as moss.

Lichens acts as bio indicators
Bio indicators are living organisms that retort in an especially clear way to a change in the environment. The hardy lichens are useful bio indicators for air pollution, especially sulfur dioxide pollution, since they derive their water and essential nutrients mainly from the atmosphere rather than from the soil. It

also helps that they are able to react to air pollutants all year round. Compared with most physical/chemical monitors, they are inexpensive to use in evaluating air pollution.

Lichens can also be used to measure toxic elemental pollutants and radioactive metals because they bind these substances in their fungal threads where they concentrate them over time. Environmental scientists can then evaluate this accumulation to determine the history of the local air.

The effects of sulphur-di-oxide on lichen diversity

Lichens are injured by sulfur dioxide (SO^2). Rose (1975) has calculated that more than one-third of England and Wales has lost nearly all its epiphitic lichens, the most delicate shrubby lichens, largely due to the sulphur-dioxide emissions of coal-burning power plants. In Northern Siberia, an area of the Soviet Union which is much polluted, the number of lichen species has fallen from 50 to about 3, and the lichen production in general stands at about 1 or 2% or normal levels, threatening the reindeer diet; in Alaska there are similar concerns about lichen reduction and the caribou diet (Tyson, 1990).

Losses in other parts of the world reflect the increasingly poor quality of the earth's air and the need for early warning bio indicators such as lichens.

This pollutant has natural sources, such as volcanic eruptions and sea spray. By far the largest source for it, however, is the combustion of fossil fuels, automobile emissions, and some industrial processes. The pollutant is carried in the atmosphere until rained out or deposited as dry particles or as gas. Sulfur dioxide combines with moisture in the atmosphere to form sulfurous acid (H_2SO_3) or sulfuric acid (H_2SO_4). When this happens with rainwater, the result is acid rain. All these forms of sulfur are harmful to lichens and plants.

Lichens have also shown sensitivity to some other pollutants, such as heavy metals and ozone, but for the most part lichen damage can be attributed to SO_2.

The effect of pollution upon lichen depends on the pH of the substrate, the surface on which the lichen grows. In general, an alkaline substrate such as basic bark or limestone counteracts the acidity of SO^2 pollution. As acid rain falls on a substrate, one kind of lichen growth form will often be replaced by another more tolerant form. In areas of high pollution lichens may be found only on sites such as wounds on trees and on sandstone walls, which have high (basic) pH.

Scientists have found that, with considerable SO_2 pollution in an area:

- The first loss of the same pH-sensitive lichens occurs on birches and conifers (acid bark and low buffering capacity);
- The next loss on oaks and sycamore (intermediate acidity and buffering capacity);
- The last on trees like elm (alkaline bark and high buffering capacity).

Use as bio-indicators

Lichens are widely used as environmental indicators or bio-indicators. If air is very badly polluted with sulphur dioxide there may be no lichens present, just green algae may be found. If the air is clean, shrubby, hairy and leafy lichens become abundant. A few lichen species can tolerate quite high levels of pollution and are commonly found on pavements, walls and tree bark in urban areas. The most sensitive lichens are

shrubby and leafy while the most tolerant lichens are all crusty in appearance. Since industrialisation many of the shrubby and leafy lichens such as *Ramalina*, *Usnea* and *Lobaria* species have very limited ranges, often being confined to the parts of Britain with the purest air such as northern and western Scotland and Devon and Cornwall.

Impacts of acid rain

Acid rain became a recognised international problem during the 1980s resulting from the dispersion of air pollutants via tall chimney stacks. Air pollution and acid deposition has led to problems for lichens on bark, particularly because the tree bark has often become more acidic. In some areas, although gaseous sulphur dioxide levels have fallen, the bark of older trees is too acidic for recolonisation, and new growth develops on twigs and younger trees. Some species of lichens have become more widely distributed than they were a century ago as they are more tolerant of acid conditions, such as some species of *Bryoria*, *Parmeliopsis*, *Pseudevernia* and *Rinodina.*

Zonation of lichens

A lichen zone pattern may be observed in large towns and cities or around industrial complexes which corresponds to the mean levels of sulphur dioxide experienced. Table 1 shows the lichen zone scale of Hawksworth & Rose (1970). Particular species of lichen present on tree bark can indicate the typical sulphur dioxide levels experienced in that area. For example if there are no lichens present, the air quality is very poor (zone 1), whilst generally only crusty lichens such as *Lecanora conizaeoides* or *Lepraria incana* can tolerate poor air quality (zone 3). In moderate to good air, leafy lichens such as *Parmelia caperata* or*Evernia prunastri* can survive (zone 6) and in areas where the air is very clean, rare species such as 'the string of sausages' *Usnea articulata* or the golden wiry lichen *Teloschistes flavicans* may grow (zone 10).

It is important to note that the zone chart in Table 1 applies to areas where sulphur dioxide levels are increasing. If sulphur dioxide conditions are falling, lichens rarely colonise in exactly the same sequence; lichens are slow growing and may take a year or two to recolonise bark or other substrates following a reduction in air pollution levels, and tiny recolonising specimens can be difficult to spot and identify.

During the early and mid-twentieth century, air pollution levels were much greater than they are today in towns and cities of the UK. Sulphur dioxide levels were highest in the inner city areas becoming less polluted out towards the edges of the urban areas. At such times, the lichen zone scale would often highlight zone 1 as the inner city area, moving through the zones to the cleaner air at the edge of the city. From the 1970s onwards, sulphur dioxide levels have been falling markedly in the central and outer areas of cities, such that there may be no differentiation between levels in central and outer areas of many cities. The fall in sulphur dioxide levels between the 1970s and the 1990s has led to a number of lichens recolonising in areas from which they had previously been eliminated.

The origin of lichens from fungi

The plant-like appearance of lichens hides their true identity. Lichen is not a single organism, but the result of a partnership (mutualistic symbiosis) between a fungus

and an alga or cyanobacteria. Some lichens are formed of three or more partners. The body of a lichen consists of fungal filaments (hyphae) surrounding cells of green algae and/or blue-green cyanobacteria. The basis of the mutualistic symbiosis in lichens is similar to the mycorrhizal partnership between some species of fungi and the roots of most plants. The lichen fungus provides its partner(s) a benefit (protection) and gains nutrients in return.

The complexity of lichen partnerships has caused lichens to be described as "small ecosystems". They are classified as members of the Fungus Kingdom by systematists because the fungus partner is always the major partner. After a lichen symbiosis is established, the fungus has the greatest influence on the final form of the lichen body's shape, and whether it is tough or flexible. The algal and bacterial partner(s) each have their own scientific names, but the lichen symbiosis is known only by the name of its fungus.

The great majority of the 13,500-18,000 species of lichenized fungi are Ascomycetes, the "cup fungi". About 20 species in the tropical and temperate rain forests are Basidiomycetes, the "mushrooms". About 40 genera of algae and cyanobacteria are found in lichen partnerships. The algal and/or cyanobacterial partner(s) possess the green pigment chlorophyll, enabling them to use sunlight's energy to make their own food from water and carbon dioxide through photosynthesis. They also provide vitamins to the fungus. Cyanobacteria can make amino acids directly from the nitrogen gas in the atmosphere, something neither fungi nor algae can do. The fungus, in turn, protects its partners from drying out and shades them from strong sunlight by enclosing the photosynthesizing partners within the body of the lichen. This life habit has allowed lichens to successfully colonize many different habitats. Lichens have a truly remarkable resistance to drought. A dry lichen can quickly absorb from 3 to 35 times its weight in water! Lichens can also absorb moisture from dew or fog, even from the air itself if the humidity is very high and the temperature is low. They also dry out slowly, making it possible for the photosynthesizing partner(s) to make food for as long as possible. This ability to quickly absorb and retain water from many sources makes it possible for lichens to live in harsh environments like deserts and Polar Regions, and on exposed surfaces like bare rocks, roofs and tree branches.

Types of Lichen

- **Foliose**: flat leaf-like lichens.
- **Crustose:** crust-like lichens that may be buried in tree bark, or even between the crystals of rocks.
- **Fruticose**: miniature shrub-like lichens. One lichen of this type is the famous "reindeer moss" of Lapland.
- **Squamulose:** scaly lichens made of numerous small rounded lobes, intermediate between foliose and crustose lichens.

Foliose crustose

Most lichens grow slowly, probably because they live in environments where water is available for only short periods. They tend to live for many years, and lichens hundreds of years old can be used to date the rock surfaces on which they grow.

Lichens spread mostly by small pieces of their body being blown around. All the

partners in the original lichen body are present in the fragment, so growth can begin immediately. Some lichens create soredia, balls of tissue made just for dispersal. Although the fungus is the major partner, dispersal by spores is rare.

Foliose

Crustose

Fruticose

Squamulose

Uses of lichens

They differ in their sensitivity to air pollution, and the presence or absence of different lichens in an area has been used to map concentrations of pollutants. Foliose lichens are used to represent trees in model train layouts. Lichens also make about 400 known "secondary products". It is thought that these chemicals are produced by lichens as defenses against disease and parasites, and, in some cases, to make the lichen taste unpleasant to animals. Some of these compounds are now used as anti-viral and anti-bacterial medications.

Other secondary products are used to make everyday life more colorful and pleasant. Some are used to scent soaps and make perfumes. Others were used in the past to dye woolen cloth. Most colors were some shade of brown or yellow, but blue was produced from a few species. The discovery of synthetic dyes ended the demand for lichen dyes. The synthetic dyes provided many more colors, and did not fade. Lichen dyes are still used by some craft weavers who like their soft, quiet colors. Today, the only commercially important lichen dye is used to make litmus paper, to test the acidity of liquids. The litmus dye turns blue in "basic" (low-acid) solutions like ammonia, and red in acid solutions like vinegar.

Lichens can be an important food source in extreme environments. The Lapp people, who live above the Arctic Circle in Scandinavia and Russia, harvest lichens as winter food for their reindeer, just like farmers in temperate zones stockpile hay.

Lichens are also significant in making soil. Soil is made up of organic matter, such as decayed plants, and minerals. Species that grow on rocks permeate and wedge apart

pieces of the rock by both pressure and chemical action. Some of their acidic secondary products dissolve the rock's surface, freeing mineral grains. This is an extremely slow process, but the flexibility and endurance of the lichen fungi puts time on their side.

References

Adrosko, R.J. (1971). Natural dyes and home dyeing. Dover Publications, New York.

Ahmadjian, V. (1967). The lichen symbiosis. Blaisdell Publishing Co., Waltham, Massachusetts.

Grae, I. (1974). Nature's color: Dyes from plants. MacMillan Publishing, New York. ISBN 0-02-544950-8.

Hale, M.E. (1968). Lichen handbook: A guide to the lichens of eastern North America. Smithsonian Institution Press, Washington, DC.

Hawksworth, D. L. Et al. (1995). Ainsworth & Bisby's Dictionary of the Fungi. CAB International, Wallingford UK. ISBN 0-85198-885-7.

Lawrey, J. D. (1984). Biology of lichenized fungi. Praeger Publishers, New York ISBN 0-03-060047-2.

Kramer, J. (1972). Natural dyes plants & processes. Chrales Scribner's Sons, New York. ISBN 684-12828-4.

Nash, H. ed. (1996). Lichen Biology. Cambridge University Press, Cambridge UK. ISBN 0-521-45368-2.

Exploration of medicinal plant resources and their utilization in Sarguja

A.S. Chandel, D.K. Yadav and M.K. Jhariya
Department of Farm Forestry, Sarguja University,
Ambikapur-497001 (C.G.)

Abstract
The exploration of medicinal plant resources and their utilization in tribal land of Sarguja was studied during 2015-2016. Ten villages were selected for investigation and total of 100 households from these villages were randomly selected and interviewed using a well structured questionnaire. There is great variation in the diversity and utilization pattern of medicinal plants utilized by the local people. Total 38 medicinal plants belonging to 25 families with different habits, medicinal value and plant parts use for economic purposes were recorded during the investigation. The life form of utilized species which are explored in this region showed mixed composition. Out of 38 plant species, trees (18), herbs (08), shrubs (04) and climbers (02) were noticed.

Keywords: Diversity, Medicinal plants, Utilization pattern,

Introduction

Forests ecosystem is playing a vital role in the socio-economic and cultural life of the tribal people of India. India is rich in biodiversity and experienced with long history of living in harmony with nature. In the present era of social, industrial and economical development these resources are seen as source of crude material. The forests in India is shrinking and under pressures over the years due to excessive exploitation and are facing many threats affecting bio-diversity, forest communities, energetic and dynamics, which leads towards impoverished forest dependent communities (Yadav et al., 2015; Painkra et al., 2015; Raj et al., 2016).

On the other hand still in some parts of the country, untouched by modern civilization these resources and their values are being preserved and conserved by the tribals or forest dwellers that are directly attached with the forest or natural resources for their sustenance (TFRI, 2013). Forests support rural livelihoods and food security in many developing countries by providing critical sources of food, medicine, shelter, building materials, fuels and cash income. The increasing demand for forest products has enhanced rural livelihoods and enabled the expansion of domestic markets, particularly in urban areas where wood fuel and other forest resources are scarce. Sustainable collection, use and commercialization are the main drivers in the promotion of forest resources for community development, poverty reduction and livelihood socio-economic improvement (Beer and Mcdermott, 1989; Edwards, 1993; Shiva and Verma, 2002), conservation and capacitating development organizations (Hamilton, 2004).

Hence, the preservation of forests is vital for sustaining ecological balance and is the most important factor to protect the environment as well as the forest communities living in and around the forest. In vew of the extremely rich

biodiversity and cultural diversity in Chhattsigarh state and dependence of forest dweller on medicinal plants present investigation was carried out to explore the medicinal plant wealth in the tribal land of Sarguja.

Material and methods

The study was carried out at ten villages *viz.*, Sakalo, Sargawan, Ghanghari, Rukhpur, Chikhladih, Khaliba, Bhagwanpur, Kalyanpur, Latori and Manjeera of Surguja division during the year 2015-2016. The study area is located between $22^0$58' to $23^0$49' North latitude and $81^0$33' to $82^0$45' East longitudes. The study was carried out by interviewing the respondents through well structured questionnaire; 100 household in 10 villages in the study site to explore the medicinal plant and their utilization pattern in the concerned study sites. Household heads or eldest members were considered as the respondents. The data collected on various aspects of medicinal plants were compiled and analyzed.

Results and discussion

The study area is rich in medicinal plant diversity, the local people practice and utilized these resources traditionally to cure various ailments. Besdies this they also utilized these resources for various purposes (table 1). A large number of traditional healers belonging to the tribal community are utilizing local plants in ethno-medicinal practices. A total of 38 medicinal plants belonging to 25 families with different habits, medicinal use and plant parts use for economic purposes were recorded in and around the study sites. Out of these total plant species, trees (18), herbs (08), shrubs (04) and climbers (02) were noticed. From the study it revealed that maximum plant species was recorded for Fabaceae and Combretaceae family, followed by Euphorbiaceae, Myrtaceae, Anacardiaceae, Apocynaceae, Liliaceae whereas 18 families include only single species over the enumerated site. According to the habit of medicinal plants concerned, the tree and herb are most frequently recorded as they cover a largest proportion in total, trees (56.25%) followed by herbs (25%) and climber is least among them (6.25%).

As per family wise distribution of medicinal plants, most frequent families were found in the order of Fabaceae and Combretaceae (each 16%) > Anacardiaceae, Euphorbiaceae, Myrtaceae, Apocynaceae and Liliaceae (each 8.00%) >Araceae, Poaceae, Rhamnaceae, Verbnaceae, Menisperma, Rubaceae, Amaryllideae, Acanthaceae, Apocynaceae, Sapindaceae, Sapotaceae, Cyperaceae, Meliaceae, Moraceae, Depterolarpaceae, Bambaceae, Annonaceae, Ebenaceae and Limiaceae (each 4%). Generally the plant collections involve destructive harvesting practices as virtually all parts of the plants like the roots, bark, wood, stem and the whole plant. In the study sites it showed the maximum use of leaves (36.84%), fruits and bark (34.21% each), root and seeds (23.68% each), flower (15.79%) followed by stem (10.53%), rhizome and milkey latex (7.90% each), whole plant, aerial part, resing, gum and pods (2.63% each).

Traditional knowledge of medicinal plants is the treasure of non-documented as well as verbal knowledge transmitted from generation after generation in local communities. The traditional knowledge with respect to health practices is eco-friendly with low side effects as well as low cost. Various scientists and

researchers are reported traditional uses of medicinal plants resources from different regions of India and globally (Badgujar et. al. 2008; Bhosale et. al., 2009; Dhole et al., 2009; Hiramath et al., 2010; Sankarnarayanan et al., 2010; Jyothi et al., 2010; Dahare and Jain, 2010; Jawale et al. 2012; Yadav et al., 2015; Painkra et al., 2015; Raj et al., 2016).

Present findings were supoorted by Painkara et al. (2015), in which study revealed 50 medicinal plant species belonging to 29 families, in which Euphorbiaceae registered as the largest family with 4 plant species (8%). Shrub showed their maximum presence (34%) followed by trees (32%), herbs (20%) and climbers (14%) during assesment of knowledge of medicinal plant and their use in tribal region of Jashpur (Chhattisgarh). Yadav et al. (2015) reported 75 medicinal plant species with varied families (40) in and around the Chendra forest of Sarguja division. Out of these plant species, trees (29), herbs (29), shrubs (12) and climbers (5) were noticed. Maximum plant species were recorded for Fabaceae family, whereas 25 families include only single species over the enumerated site. According to the habit of medicinal plants concerned, the tree and herb are most frequently recorded as they cover a largest proportion in total (each having 29 species of 38.67%) followed by shrub (12 species of 16%) and climber is least among them (5 species of 6.66%) which supported the present findings.

The importance of medicinal plants was restricted to the few specialized herbal healers and rural communities and thus much of there use was seen as primarily local interest (Arnold and Perez, 2001). Sannigrahi (2003) gave an account of 22 medicinal plants grown in agro and social forestry systems in Northeast India. These plants included 10 tree species .and 12 herbs or shrubs. Ahirwar (2015) reported 41 plants species belonging to 26 families and 37 plant genera of which 10 as herbacious plants, 8 shrubs, 19 Trees and 4 climbers from the *in-situ* plots in Boridand forest of Korea, Chhattisgarh. Medicinal Plants Sector in India need to develop a long-term strategy for achieving sustainable use and community based biodiversity conservation of valuable plant resources. Importance of medicinal plants as a vehicle for rural development and livelihood improvement of the poor communities has also been emphasized as the overall goal of the sector development (Holley and Cherla, 2005). Most of the medicinally important plants are forest based or the dwindling area of forest. Tribals of Sarguja have developed vast knowledge of plants as observed during survey work which they have acquired through their traditional practices. They use certain plants for some specific purposes (Table 1).

Conclusion

Assessment and documentation of the floral wealth are the prereqisite for the conservation of biological resources. Exploration of this diverse composition of medicianl plants with knowledge about their medicinal values are very essential for survival of tribals or forest dwellers that live in harmony with nature.

These resources are unsustainably exploited by the local healers. The challenges are now for utilization of medicinal plants and their sustainable management. Therefore, emphasis need for conservation of plants of medicinal value used by the tribal community.

Conservation of bio-diversity particularly of these areas depends upon the eco-planning. There is need of identification of species according to their status, medicinal value, occurance and subsequent conservation priority. The basic requirement for formulating conservation strategy is base line data of the biological and ecological resources of the concerned sites that can be managed on sustainable basis. There is need to facilitating a feasible mechanism for conservation, domestication, propagation and non-destructive harvesting of medicinal plant with the active participation of local people.

References

Ahirwar, R.K. (2015). Diversity of Ethnomedicinal Plants in Boridand Forest of District Korea, Chhattisgarh, India, American Journal of Plant Sciences, 6: 413-425.

Arnold, J.E.M. and Perez, M.R. (2001). Can non timber forest products match tropical forest conservation and development objectives. Ecological Economics, 39: 169-177.

Badgujar, S.B., Mahajan, R.T. and Kosalge, S.B. (2008). Traditional Practice for Oral Health Care in Nandurbar District of Maharashtra, India. Ethnobot. Leaflets, 1: 150.

Beer, J.H. and Mcdermott, M.J. (1989). The economic value of non-timber forest products in Southeast Asia, Netherlands Committee for IUCN, Amsterdam, the Netherlands.

Bhosale, S.V., Ghule, V.P., Aundhe, D.J. and Jagtat, S.D. (2009). Ethnomedical knowledge of plants used by the tribal people of Purandhar in Maharashtra, India. Ethnobot., Leaflets, 13: 1353-1361.

Dahare, D.K. and Jain, A. (2010). Ethnobotanical Studies on Plant Resources of Tahsil Multai, District Betul, Madhya Pradesh, India. Ethnobot. Leaflets, 14: 694-705.

Dhole, J.A., Dhole, N.A. and Bodke, S.S. (2009). Ethnomedicinal Studies of Some Weeds in Crop Fields of Marathwada Region, India. Ethnobot. *Leaflets,* 13: 1443-1452.

Edwards, D.M. (1993). The Marketing of Non-timber Forest Products from the Himalayas: The Trade between East Nepal and India. Kathmandu: Rural Development Forestry Network.

Hamilton, A. (2004). Medicinal plants, conservation and livelihoods. Biodiversity and Conservation, 13: 1477–1517.

Hiramath, V.T., Vijaykumar, M.M.J. and Taranath, T.C. (2010). Survey on Ethno Medicinal Plants of Jogimatti Forest Chitradurga District, Karnataka, India. Environ. We Int. J. Sci. Tech., 5: 223-233.

Holley, J. and Cherla, K. (2008). The Medicinal Plants Sector in India: A Review. Bookwell, 24/4800, Ansari Road, Darya Ganj, New Delhi-110 002 India.

Jawale, C.S., Dama, L.B., Pawar, K., Dama, S.B. and Shaikh, Y. (2012). Cestrum nocturnum (L) A Prospective Piscicide for Control of Predatory Fish Channa punctatus (Bloch.). Trends Fisheries Res., 1(1): 14-17.

Jyothi, B., Sudarsanam, G., Sitaram, B., Prasad Babu, G. and Yasodamma, N. (2010). Ethnobotanical Survey of Medicinal Plants Used in the Treatment of Dermatogenic Diseases in Chittoor District, Andhra Pradesh, India. Ethnobot. Leaflets, 14: 511-517.

Painkra,V.K., Jhariya, M.K. and Raj, A. (2015). Assessment of Knowledge of Medicinal Plants and their use in Tribal

Region of Jashpur District of Chhattisgarh, India. Journal of Applied and Natural Science, 7(1): 434-442.

Raj, A., Toppo, P. and Jhariya, M.K. (2016). Documentation and Conservation of Medicinal Plants in Barnawapara Wildlife Sanctuary, Chhattisgarh, India. Van Sangyan, 3(6): 18-22.

Sankaranarayanan, S., Barma, P., Ramachandran, J., Kalaichelvan, P.T., Deccaraman, M., Vijayalakshimi, M., Dhamotharan, R., Dananjeyan, B. and Sathya Bama, S. (2010). Ethnobotanical Study of Medicinal Plants Used by Traditional Users in Villupuram District of Tamil Nadu, India. J. Medicinal Plants Res., 4(12):1089-1101.

Sannigrahi, A.K. (2003). Growing medicinal plant as economic produces in the agro and social forestry systems in North East India. Forest Conservation and Management, 496-505.

Shiva, M.P. and Verma, S.K. (2002). Approaches to Sustainable Forest Management and Biodiversity Conservation: With Pivotal Role of Non-timber Forest Products. International Book Distributor, Dehra Dun (India).

TFRI (2013). Project report on Ecologcial Assessment of Biodiversity of Medicinal Plants in Conservation areas of Chhattisgarh and Strategies for their Protection. pp. 214.

Yadav, D.K., Jhariya, M.K., Kumar, A. and Sinha, R. (2015). Documentation and Ethnobotanical importance of Medicinal Plants found in Sarguja district. Journal of Plant Development Sciences,7 (5): 439-446.

Table 1: List of Medicinal plants along with uses found in the study site

Common Name	Botanical Name	Family	Habit	Parts Use	M	CM	E	S	CN
Amla	*Emblica officinalis*	Euphorbiaceae	Tree	Fruit, bark, flower	Digestion,diabetes, diuretic,carminative, stomachic, antidiarrheal, jaundice, laxative,	√	√	√	
Arjun	*Terminalia arjuna*	Combretaceae	Tree	Bark	For snake bites, cardio vascular diseases, congestive heart diseases				√
Babool	*Acacia nilotica (L.)*	Fabacea	Tree	Leaf, bark, stem	Toothache, dysentery, antiseptic for wounds				√
Bach	*Acorus calamus*	Araceae	Herb	Rhizome	Stomachic, purgative, anthelmintic, fever, gastric, urinary problem	√			

Baheda	*Terminalia bellirica*	Combretaceae	Tree	Seeds	For digestive trouble	√	√		
Bans	*Dendrocalamus strictus*	Poaceae	Shrub	Stem, root	Antifertility agent, astringent		√		√
Bargad	*Ficus bengalensis*	Moraceae	Tree	Milky latex	Asthma, diabetes, pain, burn			√	
Beal	*Aegle marmelos*	Myrtaceae	Tree	Stem, bark, leaves, fruit, flower	Stomatic, piles, cardiotonic, laxative, antiinflammato	√	√	√	
Ber	*Zizyphus jujube*	Rhamnaceae	Shrub	Fruit	Fruit for bile disease and cough	√	√		
Char	*Buchanania lanzam*	Anacardiaceae	Tree	Seed, root	Tonic, astringent, colling, depurative, constipating		√		
Dhawda	*Anogeissus latifolia*	Combretaceae	Tree	Leaf, bark, root	Cardie disorder, UTI infection, skin disease, fever, epileptic fits, liver complaints	√			
Gamhar	*Gmelina arboria*	Verbenaceae	Tree	Leaf, bark, root	Antidote, ulcer, stomachic, anti-gonorrhea	√			√
Giloy	*Tinospora cordifolia*	Menispermaceae	Herb/ climber	Fruit, stem, root	Antigonorrhoeic,piles, dysentery , jaundice, Skin disease, urinary disease,	√			
Haldu	*Adina cordifolia*	Rubiaceae	Tree	Bark	Bark for dysentery ,bruises and wounds	√			
Harra	*Terminalia chebula*	Combretaceae	Tree	Fruit	Seeds for leucorrhea and indigestion	√	√		
Jamun	*Eugenia jambolina*	Myrtaceae	Tree	Leaf, fruit	Antidiabetic, digestive, diarrhoea, asthma, blood purifier, anthelmintic	√	√		
Kali musli	*Curculigo orchiodes*	Amaryllidaceae	Herb	Rhizome	Root for tonic	√			

Kalmegh	*Andrographis paniculata*	Acanthaceae	Herb	Whole Plant	Blood purifier, jaundice, fever, diabetes	√			
Karonda	*Carissa carandas*	Apocynaceae	Shrub	Fruit	It sometimes used in treatment of anaemia antiscorbutic		√		
Kusum	*Schleichera oleosa*	Sapindaceae	Tree	Bark	Analgesic, antibiotic	√			
Mahua	*Madhuca latifolia*	Sapotaceae	Tree	Flower, Fruit	Leprosy and peptic ulcer	√	√	√	√
Mango	*Mangifera indica*	Anacardiaceae	Tree	Fruit	Dysentery,digestive, vitamin A, tonic	√			
Nagar motha	*Cyprus rotandus*	Cyperaceae	Herb	Aerial parts, rhizome	As tonic, cooling, intellect promoting, skin, urinary, diarrhoea, stomachic, diuretic, perfume	√			
Neem	*Azadirachta indica*	Meliaceae	Tree	Leaves, bark, flower, seed	Skin disease, toothache, antidote, fever, wound, ulcer,	√		√	
Palash	*Butea monosperma*	Fabaceae	Tree	Leave,bark, seeds, flower, gum	Urinary disorder, worms, diabetes, inflammation, astringent, cosmetic, flatulence, piles	√			
Pipal	*Ficus religeosa*	Moraceae	Tree	Milky	Diarrhoea, piles, eye trouble		√	√	
Ratanjot	*Jatropha carcus*	Euphorbiaceae	Shrub	Leaves, fruit, seeds, bark, latex	Ulcer, tumor, constipation, scabies,would healing, malaria, veterinary uses	√			
Safed musli	*Cholorophytum borivilianum*	Liliaceae	Herb	Leaf, root	Root for tonic, face cleaning, eruptions, weakness, diabetes, nerve complaints	√			

Sal (Sarai)	*Shorea robusta*	Dipterocarpaceae	Tree	Resin, Seed	Fruit for dysentery and scorpion sting	√			√
Sarpagandha	*Roulfia serpentina*	Apocynaceae	Herb	Root	Blood pressure, malaria, ulcer, snake bite, joint pain, fever	√			
Satavar	*Asparagus racemosus*	Liliaceae	Climber	Root	Tonic for bronchitis, weakness, diuretic, antidiarrheal	√			
Semal	*Bombax ceiba*	Bombaceae	Tree	Leaf, seed, bark, flower, gum	Dysentery,antidote, laxative, tonic	√			
Shisham	*Dalbergia sissoo*	Fabaceae	Tree	Leaf, bark, pods	Skin disease, gonorrhoea, dysentery, itching	√			√
Siris	*Albizia lebbek*	Fabaceae	Tree	Leaf, seed	Antidote, asthma, piles, diarrhoea	√			√
Sitafal	*Annona squamosa*	Annonaceae	Tree	Fruits, leaves, seeds, root	Constipation, vomiting, cough, purgative		√		
Tendu	*Diospyros melonoxylon*	Ebenaceae	Tree	Fruit	Gum useful for eye disease	√	√	√	√
Tulsi	*Ocimum sanctum*	Limiaceae	Herb	Leaves	Roots for cancer and seeds for tonic		√	√	

CM=Commercials S=Sacred, E= Edible, CN=Construction

Diversity of macro-fungi in central India-III: *Serpula* spp.

R.K. Verma, C.K. Tiwari, Jagrati Parihar and Shailendra Kumar
Forest Pathology Division,
Tropical Forest Research Institute
(Indian Council of Forestry Research & Education, Ministry of Environment, Forests and Climate Change, Govt. of India)
Jabalpur -482 021, Madhya Pradesh

Introduction

Several basidiomycetes species and other fungi have been found on bamboo (Boidin *et al* 1986) playing an important role in its decay in natural environments. Some polypores have been described being specific to this substrate, while others are able to decay bamboo and a variety of substrates as well (Ryvarden 1975b, Ryvarden and Johansen 1980, Hjortstam and Ryvarden 1984, Hattori 2002, Ryvarden and De Meijer 2002). *Serpula* Pers. ex (Aphyllophorales, Basidio - mycotina) Gray was with *Boletus lacrymans* Wulfen as type species and the genus is characterized by its dark brown and meruloid to poroid hymenophore, brown, doubled walled and cynophilous basidipores and by causing a brown rot on wood or bamboo. Two species of the genus have been documented in seven provinces of China (Hjortstam and Ryvarden 1988; Bi *et al.*, 1994; Li, 1991; Siuzev, 1910; Teng, 1996). During the study on wood rotting fungi of central India, collections of the fungal fruiting bodies were examined and *Serpula similis* and *S. lacrymans* were found. The purpose of this study is to describe two polypore species collected in clump of bamboo (*Dendrcalamus strictus*) and in dry twigs of *Prosopis juliflora* with a yellow to orange pore surface. This is widely distributed in SE Asia, and commonly seen on bamboo (Cooke, 1957) but also on hardwoods. *Serpula similis* is most probably a paleotropical species, frequently collected on bamboo, both in the wild and in buildings, but also on other wood such as *Leucaena glauca* (Cooke 1957).

Notably, however, S.lacrymans is very rarely found outside the built environment in Europe, with there being only one published report of its occurrence in Europe in its presumed natural environment, the forest floor (Kotlaba, 1992). Reports of the fungus from other parts of the world are also limited, although there is now good evidence that S.lacrymans resides in regions of the Himalayan foothills; however, it does not appear to be prevalemt in that natural environment (Bagchee, 1954; White et al, 1997). In the present study two macro-fungi, *Serpula similis* and *S. lacrymans* associated with clump of *Dendrcalamus strictus* and dry twigs of *Prosopis juliflora* causing stem rot are described from central India.

Materials and methods

Collection of samples

The fungal fruiting bodies were collected on 29.9.2011 and 23 January, 2006 from Peherwa (Achanakmar) Peedha (Khodri) Bilaspur Division, Manendragarh, Chorbhatti, (Chilhi), Chhatishgarh and *Prosopis juliflora*, Dapcha, Katthiwada, Jhabua, MP, N22^{0}27’690’’ E74^{0}08’858. It is situated between (22º27' 690"N latitude and 74º08'858" E longitude).All the relevant information regarding collected

fungal fruiting bodies the habit and habitat, color, texture, size and size, hymenial configuration zonations etc. were recorded at collection spot. Spore prints were also taken. Microscopic details of various parts of fruiting bodies, hyphal system and spores were studied as suggested by Teixeira (1962). Specimens of *Serpula similis* (TF3191) and *S. lacrymans* (TF448) were deposited in the mycology herbarium of Forest Pathology Division, TFRI, Jabalpur, (M.P.) India.

Identification of fungus

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

Results

Taxonomic description:

***Serpula lacrymans* (Wulfen) J. Schröt. (Fig.1)**

Synonyms:

Boletus lacrymans Wulfen, (1781)
Boletus obliquus Bolton, (1788)
Gyrophana lacrymans Wulfen, (1900)
Merulius destruens Pers., (1801)
Merulius domesticus H.G. Falk, (1912)
Merulius giganteus Saut., (1877)
Merulius guillemotii Boud. (1894)
Merulius lacrymans Wulfen, (1801)
Merulius lacrymans var. *guillemotii* Boud.,(1905)
Merulius lacrymans var. *terrestris* Peck, (1897)
Merulius terrestris (Peck) Burt, (1917)
Merulius vastator Tode, *Abh. naturforsch.* (1783)
Serpula destruens (Pers.) Gray, (1821)
Serpula domestica (Falck) Bondartsev, (1948)
Serpula terrestris (Burt) S. Ahmad, *Monogr.* (1972)
Sesia gigantea (Saut.) Kuntze, *Revis.* (1891)
Sistotrema cellare Pers., (1801)

Scientific classification:

Kingdom: Fungi
Phylum: Basidiomycotina
Class: Agaricomycetes
Order: Bolatels
Family: Serpulaceae
Genus: *Serpula*
Species epithet: *lacrymans* and *similis*

Fruit body effuso reflex, 1.5-10 x 1.5-2.0cm, easily separable from substratum, margin thick, upper surface, cream, wrinkle, zonate, cottony, hymenial surface tobacco brown, pores sallow, 2-3/mm, 2mm long, context cream white, 1.0mm thick, KOH turn dark brown, hyphal system dimitic, basidiospores rusty brown, ellipsoid, thick walled, guttulate, 7.5x5µm.

Causing brown cuboidal rot in twigs.

Fig-1 *Serpula lacrymans* fruit bodies on *Prosopis juliflora*

***Serpula similis* (Berk. & Broome) Ginns (Figs. 2-4)**

Synonymy:

Merulius similis Berk. & Broome, (1873)

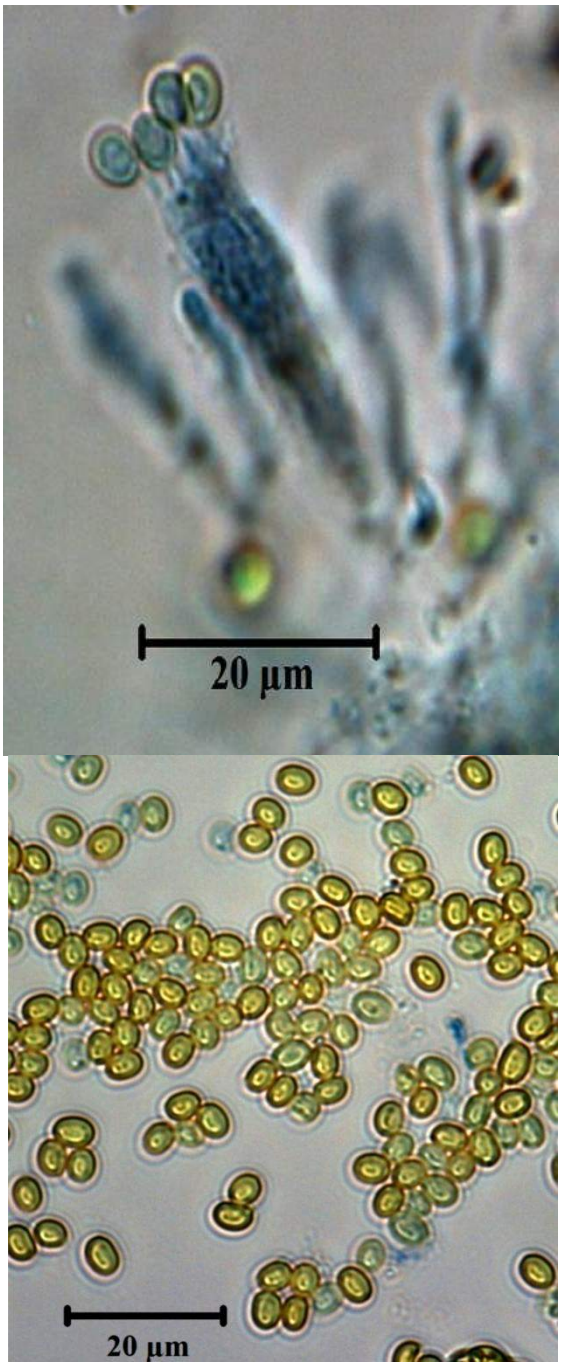
Sesia similis (Berk. & Broome) Kuntze, (1891)

Gyrophana similis (Berk. & Broome) Pat., Bull. (1923)

Figures-2: *Serpula similis* habit

Annual, resupinate to distinctly pileate, imbricate, sessile, fleshy and more or less watery when fresh, becoming corky, brittle and light in weight on drying, 80-100 x 40-45 x 12-15 (LxBxT). Pileus, flabelliform to semicircular, surface cream to light lemon yellow, azonate, uneven, smooth, tomentose, shiny, margin cream, entire, thick. Context, pale cream color, soft corky to spongy, upto 14 mm thick. Hymenium, meruloid to reticulate folds, folds more prominent and thick towards the centre, lemon yellow to turmeric yellow, poroid, pores 1-2/mm, irregular to daedaloid, poretube 1mm long, turmeric yellow. Hyphal system, dimitic, generative hyphae hyaline, clamped, branched, thin walled, granular, 2.5-6.0µm wide, skeletal hyphae hyaline, unbranched, with wide lumen, thick walled, 1.5-3.0 µm wide. Basidia, hyaline, clavate, with a basal clamp and four sterigmata, 19.5-31.0 x 3.5-7.5µm. Basidiospore, subglobbose, bright yellow, thick walled, smooth, 4.5-5.5 x 3.5-4.5µm (Figs. 1-8).Causing brown rot.

Host and Collection examined: *Serpula similis* was found in clumps of



Dendrcalamus strictus, Peherwa (Achanakmar) Peedha (Khodri), Bilaspur

Figure-3-4 *Serpula similis* basidium

attached with basidiospores, **4.** basidiospores

Division, Manendragarh, Chorbhatti, (Chilhi), CG, TF3153, collected by Jagrati Parihar and *Serpula lacrymans* on *Prosopis juliflora,* Dapcha, Katthiwada, Jhabua (M.P.) dated 23.1.06 collected by R.K.Verma.

Distribution and other known host (s): *Serpula similis* distribution of Sri Lanka, India, Nepal, China, Tropical Asia and North America and other known hosts of dead wood, bamboo, twigs etc. *Serpula lacrymans* distribution of Worldwide, North Europe, North America, New Zealand, India (J&K, Western Himalayas, Jhabua, M.P.) and other known host(s) are Spruce, fir, *Abies pindrow*.

Discussion

The dry rot fungi, *Serpula similis* and *S. lacrymans*, are one of the most important wood decay fungi in the built environment causing many hundreds of millions of pounds of damage each year in many countries around the world. *S.lacrymans* is a typical brown rot fungus utilising non-enzymatic mechanisms to modify lignin and initiate the depolymerisation of cellulose. This Basidiomycete is timber decay caused by the fungus. Notably, however, S.lacrymans is very rarely found outside the built environment in Europe, with there being only one published report of its occurrence in Europe in its presumed natural environment, the forest floor (Kotlaba, 1992). Reports of the fungus from other parts of the world are also limited, although there is now good evidence that S.lacrymans resides in regions of the Himalayan foothills; however, it does not appear to be prevalent in that natural environment (Bagchee, 1954; White et al, 1997).

References

Bagchee, K., (1954). *Merulius lacrymans* (Wulf.) Fr. in India. Sydowia 8, 80-85.

Bakshi BK. 1971. Indian Polyporaceae (On trees and timber). ICAR Publication, New Delhi. pp. 246.

Bi Z.S.; Zheng, G.Y. and Li, T.H. (1994). Macro fungusflora of Guangdong Province. Guangzhou: Sci. Tech. Press. 1-879.

Boidin J, Candoussau F, Gilles G. (1986). Bambusicolous fungi from southwest of France II. Saprobic Heterobasidiomycetes, resupinate Aphyllophorales and Nidulariales. Trans Mycol Soc Jap 27:463–471.

Cooke, W.B. (1957). The genera *Serpula* and *Meruliporia*. Mycologia 49: 197-225.

Hattori T. 2002. Type studies of polypores described by E.J.H. Corner from Asia and west Pacific areas III. Species described in Trichaptum, Albatrelus, Boletopsis, Diacanthodes, Elmerina, Fomitopsis and Gloeoporus. Mycoscience 42:423–431.

Hjortstam K. and Ryvarden L. (1984). Some new and noteworthy basidiomycetes (Aphyllophorales) from Nepal. Mycotaxon 20(1):133–151.

Hjortstam, K & Ryvarden, L. (1988) *Tomentellago* gen. nov. (Thelephoraceae, Basidiomycetes). *Mycotaxon* 31: 39–43.

Kotlaba, F., 1992. Nalezy drevomorky domaci - *Serpula lacrymans* v prirode. Ceska Mykologie 46, 143-147.

Li, R.G. 1991. Fungi flora of Jilin Province. Chuangchun: Northeast Normal Univ. Press. 1-528.

Mohanan, C. (1990). Diseases of Bamboos in Kerala. In Bamboos Current Research. I. V. R. Rao; R. Gnanaharan and C. B. Sastry (Eds.). Proceedings of International Bamboo Workshop 14-18, November 1988. Cochin. Kerala Forest Research

Institute, Peechi and International Development Research Centre, Canada: 173-183.

Mohanan, C. (1997). An Illustrated Manual of Diseases of Bamboos in Asia. International Network for Bamboo and Rattan, New Delhi.

Prasad, S. N. and Gadgil, M. 1981. Conservation of bamboo resources of Karnataka: A preliminary report. Karnataka State Council for Science and Technology, Bangalore. 24 p.

Roy A, De A. 1996 - Polyporaceae of India. International book distributor, Dehra Dun- 248001, India. pp. 309.

Ryvarden L. and Johansen I. 1980. A preliminary polypore flora of east Africa. Oslo: Fungiflora. 636 p.

Ryvarden L. 1975b. Two remarkable polypores from India. Trans Br Mycol Soc 65(3):413–417.

Ryvarden, L.; de Meijer, A.A.R. (2002) Studies in neo tropical polypores 14. New species from the state of Paraná, Brazil: In: Syn. Fung. (Oslo) 15:44.

Siuzev, P.V. 1910. Enumeratio fungorum in oriente extreme anno 1905 collectorum. Trav Nus Bot Acad Sci St. Petersb, 7: 102-110.

Teixeira A.R. 1962 a - Microstructures do Basidiocarpo sistematia do genero *Fomes* (Fries) Kickx. Rickia 1, 15-93.

Teng, S.C. 1963. Fungi of China. Beijing: Science Press. 1-808 pp.

Tewari, D.N. 1992. A Monograph on Bamboos. International Book Distributors, Dehra Dun: 498 p.

Tiwari CK, Parihar J, Verma RK and Prakasham U (2013). Atlas of wood decaying fungi of central India. Tropical Forest Research Institute, Jabalpur, MP, 166p.

Verma RK, Sharma Nidhi, Soni KK and Jamaluddin (2008). Forest Fungi of Central India. International Book Distributing Co. Lucknow, 418p.

White, N.A., Low, G.A., Singh, J., Staines, H., Palfreyman, J.W., 1997. Isolation and environmental study of “wild” Serpula lacrymans and Serpula himantioides from Himalayan Forests. Mycol. Res. 101, 580-584.

Tree stratum and forest floor biomass in the proximity of collieries

Amit Kumar, M.K. Jhariya and D.K. Yadav
Department of Farm Forestry
Sarguja University, Ambikapur-497001 (C.G.)

Abstract
The present work designed to assess the tree stratum and forest floor biomass of three sites at Kumda collieries of Bishrampur, Surajpur district of Chhattisgarh. A sum of 19 tree species distributing among 10 families were recorded across the collieries. The distribution of species revealed that most dominant family was Fabaceae in the entire concerned site. Site-I reflects 9 species representing 6 families, site-II having 10 species distributed in 7 families whereas site-III showing maximum number of species. Total forest floor biomass was found to be highest in site-III (6.07 t/ha) followed by site-II (5.21 t/ha) and site-I (2.61 t/ha). The leaf litter ranged from 1.79-4.02 t/ha, whereas wood litter varied from 0.82-2.05 t/ha, respectively. The study reveals that as the distance from mining point increases the occurance of tree species and forest floor biomass also increases. Proper planning, conservation affords, elite management practices, ecorestoration and ecodevelopment perspectives of the collieries needs to be applied for betterment of the sites.

Keywords: Forest floor biomass, Leaf litter, Tree stratum, Wood litter

Introduction

The mining activity cause severe effect on social, ecological and environmental segments including its dynamics in various ways. Mining activities leads to pollution of different environmental segments, alter the vegetation dynamics along with forest ecosystems, issues of human health and habitation has became the matter of serious concern and it needs to be address on priority basis properly. The impairment in the physical, chemical and biological quality of the environment affects human health, flora, fauna and ecological balance (Jhariya *et al*., 2013 & 2016; Kumar *et al*., 2015 & 2016; Jhariya and Yadav, 2016; Amit Kumar *et al*., 2016).

Bishrampur bestowed with rich sources of coal reserves and therefore various mining centres are situated in the region. Excessive mining in this collieries leads towards deforestation, pollution, loss of biodiversity, disrupting environmental and ecological functioning (Singh *et al*., 2013; Kumar *et al*., 2015 & 2016; Jhariya *et al*., 2013 & 2016; Jhariya and Yadav, 2016; Amit Kumar *et al*., 2016). The waste material generated due to mining operation leads to huge area under the overburden dupms which leads towards changes in topography, modify the drainage system and prevent vegetation succession (Bradshaw and Chadwick, 1980; Wali, 1987). Vegetation recruitment on collieries may influenced by the natural recovery process and site conditions. Although, various tree species are capable to grow and subsequently colonize in minining sites under the favourable soil and environmental conditions. Therefore, assessment of species, their distribution and status in a particular site faciliated idea on natural establishment and recovery of vegetation, capability and potential of

species, need of conservation priority and suitable management implications.

Material and methods

We studied Kumda collieries and its proximity of Bishrampur in Surajpur district of Chhattisgarh to assess the tree stratum and litter biomass. Three sites were concerned for the study which were categorised as Site-I (upto 1 km from mining point), Site-II (1 to 3 km) and Site-III (more than 3 km) based on distance from the mining operation point. In each site 10 x 10 m size quadrat was randomly laid for measuring tree species and 50 cm x 50 cm quadrats was laid for quantification of litter biomass.

Results and discussion

Floristic composition of tree species

The occurance and distribution of tree species in different sites of collieries revealed that a sum of 19 tree species distributing in 10 families were recorded across the site (table 1). The familywise contribution to the total number of species followed the order Fabaceae (6 species) > Myrtaceae (3 species) > Lamiaceae, Mimosaceae (2 species each) > Ebenaceae, Meliaceae, Phyllantahceae, Moraceae, Annonaceae, Rhamnaceae (1 species each), respectively. The result revealed that the species like *Cassia siamea*, *Pongamia pinnata*, *Tectona grandis* and *Ziziphus mouritiana* were found to be common in all the sites. Whereas the species *Acacia nilotica*, *Albizia lebbeck*, *Albizia procera*, *Annona squamosa*, *Artocarpus heterophyllus* and *Butea monosperma* were reported in site-III only (table 1).

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

Species	Site-I	Site-II	Site-III
Acacia mangium	+	--	+
Acacia nilotica	--	--	+
Albizia lebbeck	--	--	+
Albizia procera	--	--	+
Annona squamosa	--	--	+
Artocarpus heterophyllus	--	--	+
Azadirachta indica	+	+	--
Butea monosperma	--	--	+
Cassia siamea	+	+	+
Dalbergia sissoo	--	+	+
Diospyros melanoxylon	+	+	--
Eucalyptus globulus	+	--	+
Gmelina arborea	+	--	--
Phyllanthus emblica	--	+	--
Pongamia pinnata	+	+	+
Psidium guajava	--	+	--
Syzygium Cumini	--	+	+
Tectona grandis	+	+	+
Ziziphus mouritiana	+	+	+

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

The familywise distribution of species revealed that the family Fabaceae was found to be predominant in the entire concerned site. Site-I reflects 9 species with 6 families, site-II has 10 species with 7 families whereas site-III has maximum number of species i.e., 15 with 7 familes in Kumda collieries (table 2). The representation of Annonaceae, Mimosaceae and Moraceae families were reported in site-III only.

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

Species	Site-I	Site-II	Site-III	Overall
Annonaceae	-	-	1 (6.66)	1 (5.26)
Ebenaceae	1 (11.11)	1 (10.0)	-	1 (5.26)
Fabaceae	3 (33.33)	3 (30.0)	6 (40.0)	6 (31.57)
Lamiaceae	2 (22.22)	1 (10.0)	1 (6.66)	2 (10.52)
Meliaceae	1 (11.11)	1 (10.0)	-	1 (5.26)
Mimosaceae	-	-	2 (13.13)	2 (10.52)
Moraceae	-	-	1 (6.66)	1 (5.26)
Myrtaceae	1 (11.11)	2 (20.0)	3 (20.0)	3 (15.78)
Phyllanthaceae	-	1 (10.0)	-	1 (5.26)
Rhamnaceae	1 (11.11)	1 (10.0)	1 (6.66)	1(5.26)
Total	**9**	**10**	**15**	**19**

Forest floor biomass in kumda collieries

Forest floor biomass in different sites of Kumda collieries was calculated and presented in table 3. The total forest floor biomass was found to be highest in site-III (6.07 t/ha) followed by site-II (5.21 t/ha) and site-I (2.61 t/ha). The leaf litter ranged between 1.79-4.02 t/ha, whereas wood litter varied from 0.82-2.05 t/ha, respectively. The average value of leaf litter, wood litter and total forest floor biomass was 3.05 t/ha, 1.58 t/ha and 4.63 t/ha, respectively across the different mining sites. The overall contribution of leaf and wood litter in total forest floor biomass was 68.58% leaf and 31.42% wood in site-I, 64.30% leaf and 35.70% wood in site-II, 66.23% leaf and 33.77% wood in site-III, whereas it was 65.87% leaf and 34.13% wood for average forest floor biomass across the collieries, respectively.

Table 3 : Forest Floor Biomass (t/ha) in different sites of Kumda Collieries

Site	Leaf Litter	Wood Litter	Total
Site-I	1.79±0.22	0.82±0.07	2.61±0.18
Site-II	3.35±0.41	1.86±0.32	5.21±0.38
Site-III	4.02±0.40	2.05±0.20	6.07±0.43
Average	**3.05±0.20**	**1.58±0.14**	**4.63±0.22**

There is great variation in tree stratum and forest floor biomass in different mining sites. It is the direct consequenes of biotic disturbances which influencing the vegetation and litter dynamics of the sites. Our findings showed that level and intensity of the pressure or distrubance regimes decreases the increment in number of species, occurance, family richness and total litter biomass was recorded. This is supported by the fact that the scale of disturbance in a ecosystem get reduced the least impact on vegetation dynamics and functioning. In present investigation 19 tree species with 10 families were recorded across the collieries. Singh *et al*. (2014) reported 25 tree species for mining sites of Jharkhand. Tom-Dery *et al*. (2012) reported 8 tree species across the mined and unmined site of northern Ghana. Furthermore, they reported a total of 18 woody species comprised 14 families and Leguminosae was found to be most dominant family, which supported the present findings of our study. Similarly, Atugbire (2010) reported a total of 14 woody species, of which 12 were represented by tree species in the Bolgatanga.

In the forest ecosystem rate of litter production, decomposition and nutrient release represent major pools and pathway of nutrient transfer from vegetation compartments to soil. The site conditions, species pool and disturbance regimes control the vegetation dynamics, soil biota and different properties of soils. Disturbance regime also influences the amount of organic matter accumulatin and cycling of nutrient from different compartments (Jordan, 1985; Yadav *et al*., 2008; Jhariya, 2014). Therefore, the information on littermass and litterfall pattern, rate and quality are potential keys to describe changes goverened by natural and anthroporgenic means (Sizer *et al*., 2000; Jhariya, 2014).

In our findings its found that the total litter biomass was more than twice in site-III which is located much faraway from mining point as compared to anthropogenically disturbed area (site-I). The present range of the forest floor biomass is well comparable with Kumar (2015). He reported that the forest floor biomass in different site of mining areas was 4.20 t/ha in eastern direction, of which 95.23% constituted by leaf litter and remaining (4.77%) by wood litter. While in the western direction the total forest floor biomass was 5.30 t/ha, of which 90.5% contributed by leaf litter and remaining (9.5%) by wood litter. In the northern direction, the total forest floor was 4.91 t/ha, of which 72.8% constituted by leaf litter and remaining (27.2%) by wood litter. Similarly in the southern aspect the total forest floor biomass was 5.65 t/ha, of which 64.51% shared by leaf litter and remaining (35.49%) by wood litter, respectively. Furthermore, the litter biomass in different plantation site of coal mine was 4.01 t/ha in eucalyptus plantation, of which 61.34% constituted by leaf litter and remaining by wood litter. While in the teak plantation it was 1.98 t/ha, of which 98.48% contributed by leaf litter and remaining by wood litter. In the mixed plantation, the total litter biomass was 2.78 t/ha, of which 66.91% constituted by leaf litter and remaining (33.09%) by wood litter, respectively (Kumar *et al*., 2016), which were found well withing the range of present calculated values.

Conclusion

Site-I was found to be more degraded and has less floral diversity in terms of speceis presence, their occurance and distribution over the concerned collieries. The litter biomass was also found to be least in this site. The tree species were not distributed uniformly and any distinctive pattern were not found. Tree stratum showed mixed composition and varied across the sites of the collieries. Mining activities in collieries have substantial impact on tree species and litter biomass. Vegetation recovery which can be obtained by regeneration of species with proper protection measures must be implemented followed by plantation activities in the proximity of collieries. It is suggested that reforestation of degraded sites should be carried out to improve the vegetation cover and site condition which leads towards restoration of the sites.

References

Amit Kumar, Jhariya, M.K. and Yadav, D.K. (2016). Inventory of Understory Vegetation in Degraded Landscape of Collieries. Van Sangyan, 3(11): 13-19.

Atugbire, J.A. (2010). Survey of Woody Vegetation in Tankwiddi East Forest Reserve in Bolgatanga Municipality. Unpublished BSc. Thesis, University for Development Studies. Tamale.

Bradshaw, A.D. and Chadwick, M.J. (1980). The Restoration of Land: The ecology and reclamation of derelict and degraded land. University of California Press, Los Angelese, CA. p 317.

Jhariya, M.K., Bargali, S.S., Swamy, S.L. and Oraon, P.R. (2013). Herbaceous diversity in proposed mining area of Rowghat in Narayanpur District of Chhattisgarh, India. Journal of Plant Development Sciences, 5(4): 385-393.

Jhariya, M.K. (2014). Effect of forest fire on microbial biomass, storage and sequestration of carbon in a tropical deciduous forest of Chhattisgarh. *Ph.D. Thesis*, I.G.K.V., Raipur (C.G.), pp. 259.

Jhariya, M.K., Kittur, B.H. and Bargali, S.S. (2016). Assessment of herbaceous biomass: A study in Rowghat mining areas (Chhattisgarh), India. Journal of Applied and Natural Science, 8(2): 645-651.

Jhariya, M.K. and Yadav, D.K. (2016). Under storey Vegetation in Natural and Plantation Forest Ecosystem of Sarguja (C.G.), India. Journal of Applied and Natural Science, 8(2): 668-673.

Jordan, C.F. (1985). Nutrient cycling in tropical forest ecosystems. Wiley. Chichester. UK. p. 190.

Kumar, A. (2015). Impact of coal mining on floristic composition and diversity. M.Sc. (Farm Forestry) Dissertation, Sarguja University, Ambikapur (C.G.), India. Pp. 76.

Kumar, A., Jhariya, M.K. and Yadav, D.K. (2015). Community Characters of Herbaceous Species in Plantation Sites of Coal Mine. Journal of Plant Development Sciences, 7(11): 809-814.

Kumar, A., Jhariya, M.K. and Yadav, D.K. (2016). Vegetation Dynamics in Plantation Sites of Collieries. Nature, Environment and Pollution Technology, (In Press).

Singh, P.K., Imam, A., Singh, R., Singh, D. and Sharma, S. (2013). A study about ecological imbalance in Surguja (India) coalfield area due to mining. Int. Res. J. Environment Sci., 2(4): 10-14.

Singh, R.B.P., Singh, A. and Choudhary, S.K. (2014). Impact of Opencast Coal Mining on the Quality of Surfacewater, Groundwater and Vegetation: A Case Study in Simlong Coalfield, Sahibganj,

Jharkhand. International Journal on Emerging Technologies, 5(2): 95-105.

Sizer, N.C., Tanner, E.V.J. and Kossmann Ferraz, I.D. (2000). Edge effects on litterfall mass and nutrient concentrations in forest fragments in Central Amazonia. J.Tropical Ecology, 16: 853-863.

Tom-Dery, D., Dagben, Z.J. and Cobbina, S.J. (2012). Effect of Illegal small-scale mining operations on vegetation cover of arid northern Ghana. Research Journal of Environmental and Earth Sciences, 4(6): 674-679.

Wali, M.K. (1987). The structure dynamics and rehabilitation of drastically disturbed ecosystems. In Perspectives in Environmental Management (ed. T.N. Khoshoo), 163-183. Oxford Publications, New Delhi.

Yadav, R.S., Yadav, B.L. and Chhipa, B.R. (2008). Litter dynamics and soil properties under different treespecies in a semi-arid region of Rajasthan, India. Agroforestry Systems, 73: 1-12.

Know Your Biodiversity

Swaran Lata and Preeti Kaushal
Himalayan Forest Research Institute (HFRI)
(Indian Council of Forestry Research & Education, Ministry of Environment, Forests and Climate Change, Govt. of India)
Shimla (Himachal Pradesh)

***Ailurus fulgens* F.Cuvier**

Ailurus fulgens also known as red panda and red bear-cat is a mammal found throughout the eastern Himalayan mountain regions between 2200-4800 meters elevations in northern Burma, Nepal, India and southwestern China. In India, they found in Sikkim, Assam, Arunachal Pradesh and temperate forests of the Himalayas and also crowned as state animal of Sikkim. The red panda is the only living species of the genus *Ailurus* and the family Ailuridae and order carnivora. Earlier it has been placed in the raccoon and bear families, but the results of phylogenetic research provide strong support for its taxonomic classification in its own family Ailuridae.

Red Panda has reddish-brown fur, a long, shaggy tail, and is slightly larger than a domestic cat. The weight of Red panda is varies between 3 to 6.2 kg. Head to body length is between 50 to 64 cm, and the length of tail is between 30 to 52 cm. Red panda is one of the beautiful and colorful animal. The color of upper body is bright reddish-brown. They have soft and dense furs, which helps to keep it warm during the winter. The under parts and legs are dark brown or black in color. They also have thick and woolly fur on the under parts and legs which not only helps to keep their feet warm but also prevents them from slipping on the wet branches. They have reddish brown mask-like markings over the eyes. The color of eyes is dark brown. The light compact face has white badges with tear markings and robust cranial dental feathers, but each individual can have distinctive markings. Their roundish head has medium-sized with upright ears and the borders around the ears are primarily white. They has black nose. The tail is long and bushy with many alternating red and buff or yellowish rings and the soles of the feet are covered with thick white hair to provide warmth. The legs are black and short with thick fur on the soles of the paws. Red panda has semi-retractable claws to aid climbing and stability amongst the branches. Males are slightly larger than females. They are excellent climbers, and the semi-retractable claws allow them to be efficient climbers. Red panda is an omnivorous animal and usually feed on small mammals, birds, eggs, insects, leaves, bark, fruits, flowers and berries. They mainly feed on bamboos. They also feed on mushrooms, roots, acorns, lichen and grasses. Red panda is generally a solitary animal, except during their mating season. It is nocturnal and is mostly active in the early morning and late afternoon, and sleeping on tree branches or in tree

hollows during the day. They have a wide range of vocalizations, the most peculiar of which is a 'quack-snort'. Males occupy territories that overlap those of several females, especially in the mating season, and territories of both sexes are marked with anal secretions. They have several ways of marking their territories and home ranges, like marking with urine, secretions from anal glands, and scents from glands on the pads of their feet. Shortly after waking, they clean their fur like a cat, licking their front paws and then rubbing their backs, stomachs and sides. They also rub their backs and bellies along the sides of trees or rocks. The age of sexual maturity is between 18 to 24 months and breeding season is between January to July. Both sexes may mate with more than one partner. Cubs are 2 to 4 in numbers and gestation period is between 3 to 4 months. Female will make a nest out of grass, leaves and twigs in either a hollow tree or rock crevasse during the gestation period. After birth, the mothers clean the cubs and are able to recognize each by its smell. Young are born blind and helpless; they open their eyes after 16 to 20 days. After about 90 days, they have achieved full adult fur and coloring, and begin to venture out of the nest. The cubs stay with their mother until the next litter is born in the following summer. The average lifespan of Red pandas is between 8 to 14 years.

Red panda is a Schedule – I animal, according to wildlife (Protection) act, 1972 and classified as Vulnerable (VU) by the IUCN because its wild population is estimated less than 10,000 mature individuals and continues to decline due to habitat

loss and fragmentation, poaching, and inbreeding depression, although red pandas are protected by national laws in their range countries. The primary threats to red pandas are direct harvest from the wild, live or dead, competition with domestic livestock resulting in their habitat degradation, and deforestation resulting in habitat loss or fragmentation. In India, the biggest threat seems to be habitat loss followed by poaching, while in China, the biggest threat seems to be hunting and poaching. India is trying its best to conserve the red panda and hunting is completely illegal here. India has 20 protected areas with known or possible red panda populations in Sikkim, Arunachal Pradesh, and West Bengal such as Khangchendzonga National Park, Namdapha National Park, and Singalila National Park, and a coordinated conservation policy for the red panda.

***Aristolochia elegans* Mast.**

Aristolochia elegans commonly known by multiple names as Calico Flower, Duck Flower, Dutchman's pipe, Elegant Dutchman's and Battakh Phul due to its shape. It belongs to family Aristolochiaceae and order Piperales.

The plant is a climbing beautiful vine with solitary, axillary, very unusual flowers

resembling a Sherlock Holme's pipe (hence the common name of "Dutchman's pipe") and with beautiful green heart-shaped leaves that can reach about 3-4.5 meters in length. Stems of the *A. elegans* are slender, woody, twine gracefully in tight coils around fence wire and other supports lifting itself to heights of 3-4.6 m. Leaves are bright green in color, forming dense attractive foliage whereas petiole is auriculate at base, 3-5 cm long. Flowers are solitary, axillary, 7-8 cm long, on 4-10 cm long pedicels, heart-shaped, and greenish yellow with intricate purplish-brown markings. The inner surface of the flared mouth is completely purplish-brown. Perianth limb is inflated, disk-shaped, 10 cm in diameter, abruptly spreading from the tube, pale yellowish green, swollen, contracted at the mouth, funnel-shaped at top, rich purple with creamy white markings and bent. Gynostemium is 8 mm high, 5 mm wide. Stamens are 6 in number. Fruits (Capsules) cylindrical, beaked with 0.5-1 cm long beak, 4.5-6 cm long, 2.5 cm in diameter, dry, dehiscent, splitting like small parachutes. Seeds are numerous, flat, 6 mm long, winged, easily dispersed by wind. Flowering and Fruiting occurs usually in June-July.

A. elegans prefers acid-neutral soils (pH 5.5-7) and average moisture, in part sun to shade. An ornamental plant found in Indian gardens, rarely in hedges. The plant is native to Brazil, invasive species in Australia and in the southern United States. In Australia, *A. elegans* is fatal to the caterpillars of *Ornithoptera euphorion* and of the threatened Richmond Butterfly and threatens to displace their proper host plant, *A. tagala* .In India this plant is mostly found in cultivated forms. Altitude range varies from 0-1150 m in height.

Plnat contains aristolochic acid, a toxic alkaloid and is an ornamental vine cultivated in Hawai'i and other tropical areas for their colourful and unique pipe shaped flowers. It is especially good at covering chain link and other wire fences. Member of the genus *Aristolochia* are also called birthworts and are occasionally encountered in herbal preparations as a remedy for various ailments as well as to ease the pain of childbirth. They are also sometimes used to treat malaria and other diseases. Nevertheless, all of these plants are highly toxic, especially to the kidneys. Avoid herbal supplements containing members of this genus. Incorrect doses can cause vomiting, pain and even death.

A. elegans is classified as a Category II (an invasive exotic that has increased in abundance or frequency but has not yet altered plant communities to the extent shown by Category I species. *A. elegans* is sparingly cultivated climber in India. As this plant is not widely planted, thus it is currently distributed in a few lowland rural and residential areas. However, the plant is ornamental and looks beautiful but it is not certain how widespread and invasive this species will become, though it readily spreads from gardens via numerous flat winged seeds. *A. elegans* can be put on the noxious weed and to help prevent further spread through horticulture trade. Thus, there should be proper check for these cultivated plants, so that in future, it will not affect adversely later to humankind and can be utilized for its medicinal purposes.

References

Burkill, H.M., (1985). The useful plants of West Tropical Africa. 2nd Edition. Volume

1, Families A–D. Royal Botanic Gardens, Kew, Richmond, United Kingdom. 960 pp.

Choudhury, A., (2001). An overview of the status and conservation of the red panda Ailurus fulgens in India, with reference to its global status. *Oryx*. Flora & Fauna International. 35 (3): 250–259.

Forest Starr, Kim Starr, and Lloyd Loope., (2003). *Aristolochia littoralis* Calico flower Aristolociaceae". United States Geological Survey--Biological Resources Division Haleakala Field Station, Maui, Hawai'i.

Mace, G.M. and Balmford, A., (2000). Patterns and processes in contemporary mammalian extinction. In Priorities for the Conservation of Mammalian Diversity. Has the Panda had its day? A. Entwhistle and N. Dunstone (eds). Cambridge University Press, Cambridge. pp. 27–52.

Wunderlin, R. and B. Hansen., (2000). Atlas of Florida Vascular Plants. Institute for Systematic Botany, University of South Florida, Tampa, FL.

https://en.wikipedia.org

http://natureconservation.in

http://eol.org

http://floridata.com

Tropical Forest Research Institute

Published by:

Tropical Forest Research Institute
(Indian Council of Forestry Research & Education)
(An autonomous council under Ministry of Environmnet, Forests and Climate Change)
P.O. RFRC, Mandla Road
Jabalpur – 482021 M.P. India
Phone: 91-761-2840484
Fax: 91-761-2840484
E-mail: vansangyan_tfri@icfre.org
Visit us at: http://tfri.icfre.org or http://tfri.icfre.gov.in