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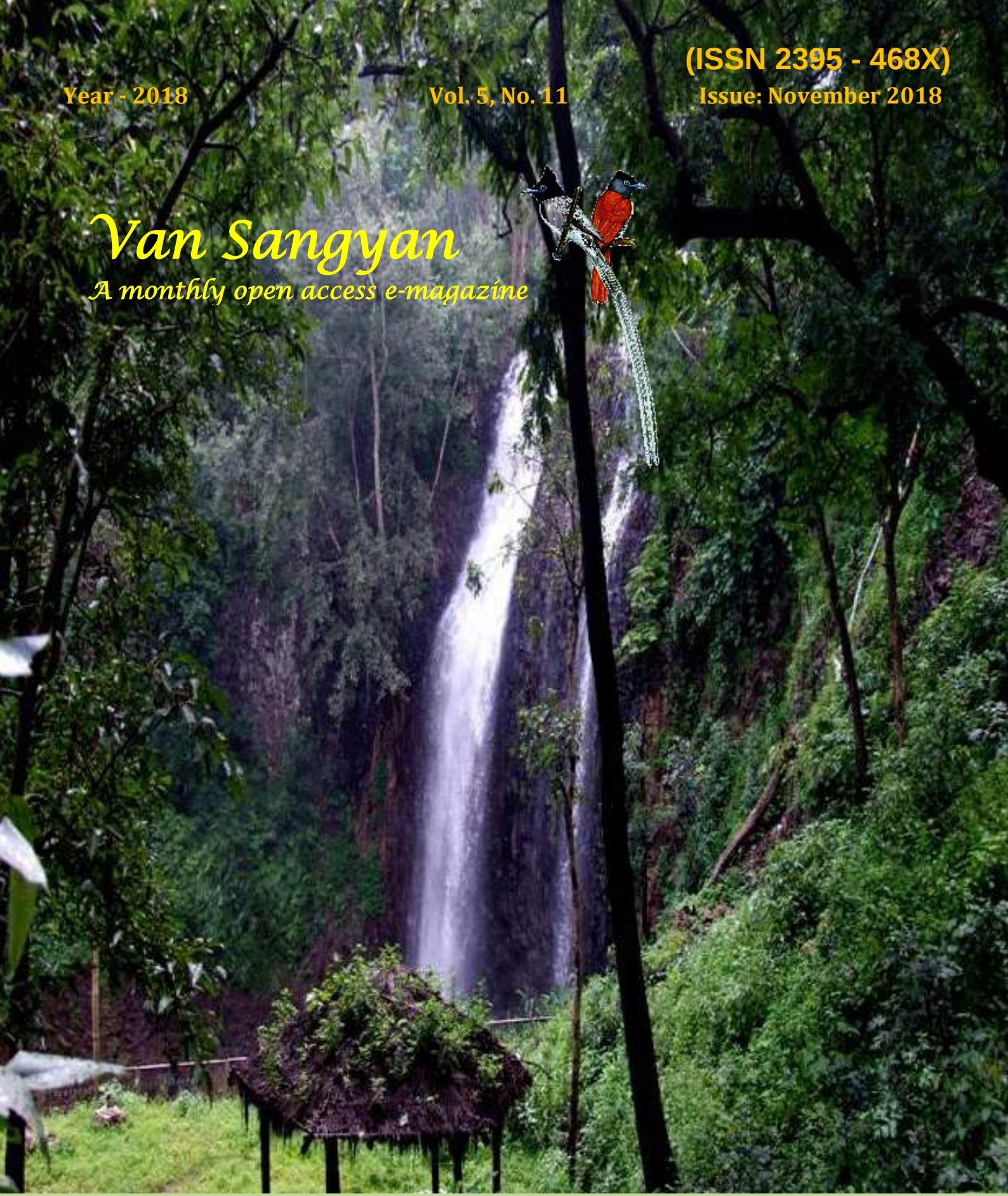

Van Sangyan

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Van Sangyan

Note to Authors:

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

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The articles can be in English, Hindi, Marathi, Chhattisgarhi and Oriya, and should contain the writers name, designation and full postal address, including e-mail id and contact number. TFRI, Jabalpur houses experts from all fields of forestry who would be happy to answer reader's queries on various scientific issues. Your queries may be sent to The Editor, and the expert's reply to the same will be published in the next issue of Van Sangyan.

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

From the Editor's desk

Species diversity in the tropics varies dramatically from place to place. Compared to other tropical forest types, dry deciduous forests are among the most exploited and endangered ecosystems of the biosphere. The Indian subcontinent, with its rich biodiversity, is one of the 12 mega-diversity centers of the world. The Eastern Ghats, the Western Ghats and the north eastern hills are the main biodiversity hotspots of India. Primary forests of Asia, particularly those of the Western Ghats and the Eastern Ghats of peninsular India are disappearing at an alarming rate due to anthropogenic activities and are replaced by forests comprising inferior species or their land use pattern changed (Bahuguna, 1999). Studies from Forest Survey of India showed an average of 54.7% of forest is affected by fire and 72.1% of the forest area is subjected to grazing. Annually 3.73 million hectares of the forest area are burnt resulting in economic losses of approximately 440 crores.

Information on floral composition, diversity and biomass are absolutely essential in understanding the forest ecosystem dynamics and conservation. It may become a tool to estimate the level of adaptation to the environment and their ecological significance. Tropical dry deciduous forests are enriched with economically important species. Vegetation composition, diversity of species and their habitats are well understood for other tropical forest types compared to dry deciduous forests.

In Eastern Ghats of India, few quantitative phytodiversity inventories are available from the forests of Eastern Ghats of Tamil Nadu (Kaduvul and Parthasarathy, 1999a, b; Jayakumar et al., 2002; Natarajan et al., 2004). These kinds of studies are poorly explored for these aspects in the State of Andhra Pradesh, which covers a major part of Eastern Ghats.

Tremendous diversity in tropical tree species has long been a source of fascination and research. In tropics, India is among the few countries endowed with rainforests, in the Western Ghats and the North-east. More interestingly, in the north-eastern Indian Ocean 7170.69 km^2 of forest area (State Forest Report, 2003) are represented in the Andaman and Nicobar Islands (6°45' to 13°41' N and 92°12' E to 93°57' E), which are peaks of a submerged mountain hill range, arching from Myanmar in the north to Sumatra and Indonesia in the south (Saldanha, 1989). Dense forests, which constitute 86.93% of the total geographic area of the Andaman and Nicobar Islands are unique in plant species richness, many of them are local endemics; their existence and intactness are undoubtedly critical in preserving the world's biodiversity, as it also falls under one of the eight hottest hot spots of biodiversity in the world viz., the Indo-Burma. These forests contribute considerably to the stability of regional climate and harbor rich biodiversity, which has not been fully documented yet.

In line with the above this issue of Van Sangyan contains an article on Structure and floristic composition of tree diversity in wet bamboo breaks of North Andaman, India. There are other useful articles viz. Diversity of macro-fungi in Central India-XIX: Humaria hemisphaerica, a cup fungus, Role of kairomones in integrated pest management, Heavy outbreak of Poplar defoliator in Kaza (Spiti) Wildlife Sanctuary (Himachal Pradesh) सामाजिक एवं लाभकारी कीट and कत्था उत्पादक खैर.

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

Looking forward to meet you all through forthcoming issues

Dr. R. K. Verma
Scientist 'G' & Chief Editor

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Structure and floristic composition of tree diversity in wet bamboo breaks of North Andaman, India

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Abstract
Tree diversity, species richness, basal area, population structure and distribution patterns were investigated in the Andaman Wet Bamboo Breaks forest type in North Andaman (13^o 06' 02'' N, 92^o 57' 11'' E), Andaman Islands. A study was conducted to analyze diversity richness and correlation between different diversity richness at species level. Nine Quadrates of 10x10m sample plots were laid out randomly and enumerated the trees for various studies. Species wise Importance Value Index, Shannon-Weiner index, Simpson index were calculated. Tree density varies from 11.11 to 1011.11 ha^{-1} with the average basal area of 86.90 m^2/ ha^{-1}. Shannon-Weiner Index (H') ranges from 0.046 to 0.086. The Simpson index varies from 0.0123 to 0.0494. The Margalef Species Richness Index varies from 7.95 to 150.35. Further, the relative density (1.00 to 91.0), relative frequency (5.56 to 50.0) and relative dominance (1.39 to 40.72) were studied in the Andaman wet bamboo breaks forest, North Andaman. The population density of tree species across girth class intervals shows that 33.30% of the trees belong to 30-60 cm gbh followed by 20% of the trees under the 60-90 cm gbh, 10% of trees under 90-120 cm gbh and only 20% of the trees in 150-180 cm gbh category. The present study can serve as baseline information for long term monitoring and sustaining the phyto-diversity of Andaman Wet Bamboo Breaks forest in North Andamans.

Key words: Andaman, Wet Bamboo Breaks forest, Relative frequency, population density.

Introduction

The structure and composition of semi evergreen forests especially in Andamans, after the Tsunami, undergo changes with the length of wet period, amount of rainfall, latitude and altitude and impacts of human and livestock activities. As a result there is a great deal of spatial and temporal variation in species richness, composition and productivity across this type of forest in Andaman's. On account of their economic exploitation, semi evergreen forests are the most ecosystems in India. An increasing interest in the development and management of natural forests has given rise to the need to understand the community structure and ecosystem stability (Anitha *et al*., 2007). Rapid loss of tropical forests is recognized as one of the serious environmental and economic problems all over the world (Hare *et al.* 1997). A number of conservation biologists have raised concern over loss of biodiversity in tropical forests owing to the deforestation and imprudent infra-structure development in the name of modernization.

Due to a tropical hot and humid climate with abundant rains, all the major islands support very luxuriant and rich vegetation. In Andaman's, about 84.4% of the total geographic area of Andaman & Nicobar Islands is under forest cover. Of the total forest cover, 42.1% are very dense forest, 34.1% are moderately dense forest, 8.2%

are open forest and the mangrove forests constitute 9.6%. Andaman and Nicobar Islands experiences a tropical climate, without any extremes except for the rains and thunder storms. Rainfall is common in the Islands, and is generally divided into two phases: May to mid September and November to mid December. Thus, the climate of Andaman and Nicobar Islands is highly favorable for the evergreen forest.

Moreover, it can be said that the soil and vegetation of any place is connect to each other. Therefore, the soil and vegetation in Andaman and Nicobar Islands is complementary to each other.

Hence, the present study is conducted an attempt to record structural composition in Andaman Semi Evergreen forest types in South Andaman in Andaman group of Islands, India. This outcome would be useful for formulating appropriate conservation strategies.

Materials and Methods

The present study was conducted in the Wet Bamboo breaks Forest type (13^o 06' 02'' N, 92^o 57' 11'' E) in Nabagran range, North Andaman, Andaman Islands. In the wet bamboo breaks, 10x10m quadrants (9 Nos.) were laid out and recorded the tree occurrences and recorded the girth. Also, made 5x5m quadrants (5 Nos.) and recorded the herbs, climbers and saplings. Finally, 1x1m quadrants (5 Nos.) were made for herbs and regeneration status of the particular forest type. The collected data were analysed for various biodiversity indices.

Data analysis

The vegetation data were quantitatively analysed for basal area, relative density, relative frequency and relative dominance (Phillips, 1959). The Importance Value Index (IVI) for the tree species was determined as the sum of the relative frequency, relative density and relative dominance (Cottam and Curtis, 1956).

Basal area (m2) = Area occupied at breast height (1.37 m) = $(p-(dbh/2)^2)$.

Relative density
= No. of trees of species/total number of trees of all speciesX100
Relative frequency
= No. of times species occurs/total number of speciesX100
Relative dominance
= Total basal area of a species/total basal area of all speciesX100
Importance Value Index (IVI) =
Sum of relative density + relative frequency + relative dominance

Species diversity of each forest type was determined using Shannon-Weiner Index (H') = Sum ((ni/N)In (ni/N)) (Shannon and Wiener, 1949; Odum, 1971).

Where,
ni = IVI of individual species
N – IVI of all species.

Concentration of dominance was also measured using the formula (Simpson, 1949); C= -S(ni/N), where, ni and N are the same as those for the Shannon-Weiner information function.

Results and discussion

A total of 100 tree species were recorded from the wet bamboo breaks forest from North Andaman representing 8 genera in 8 families. The mean density (stem ha-1) was 1111.11 stem ha^{-1}. The mean basal area was 86.90 m^2 ha^{-1}. The species richness in the wet bamboo breaks, in North Andaman was 100. In the forest, the most abundant families are Graminaceae (91 individuals) and Meliaceae, Sterculiaceae (each 2 individuals). The least by Opiliaceae, Bombacaceae, Dipterocarpaceae and Anacardeaceae (each 1 individual) (Table-4).

. An obvious variation in representation of tree species and the proportion of dominant species in the three locations can directly be attributed to the rainfall distribution and favourable edaphic condition. The most frequently occurring species in wet bamboo breaks of North Andaman was *Oxytenanthera nigrociliata*

the only bamboo species is dominant. The remaining tree species are found sporadic here and there presents and the numbers of individuals are very limited.

Table-1: Consolidated details of species details inventory in North Andaman.

Description	North Andaman
No. of tree species	100
No. of genera	8
No. of families	8
Density (stem ha^{-1})	1111.11
Species diversity index (H')	0.473
Simpson index	0.0229
Basal area (m^2 ha^{-1})	86.90
No. of shrub species	3
No. of herb species	43
No. of climber species	8

Simpson's Diversity Index is a measure of diversity and it is often used to quantify the biodiversity of a habitat. It takes into account the number of species present, as well as the abundance of each species. The Simpson index varies from 0.0034 to 0.0.494 to various species concerned. On an average, the Simpson index of this forest is 0.0229 means that, this forest is rich in biodiversity with herbs, shrubs, climbers and trees. The species diversity index (H') was 0.473 in this forest shows that, the species diversity is much less due to bamboo species occupies more individuals (clump) than the other species. Further, the forest is not disturbed and more stable environment.

Diversity indices take into account both species richness and the relative abundance of each species to quantify how well species are represented within a community. The biodiversity indices like relative density, relative frequency, relative dominance, IVI were worked out for the top ten species from the above said forest. It was noted that, *Oxytenanthera nigrociliata* species was recorded maximum IVI (150.35) followed by *Lannea coramandelica* (62.95), *Pterospermum aceroides* (58.61) and the least by *Dysoxylum arborescens* (23.62). From above study, it was noticed that, the *Oxytenanthera nigrociliata* is the most dominant species in the wet bamboo breaks forest type, obviously according to the particular forest type, followed by *Lannea coramandelica* (Table-2).

Table-2. Ecological dominance of top ten species (based on IVI) for Andaman wet bamboo breaks

S.No	Plant Species	Relative Density	Relative Frequency	Relative Dominance	IVI	Simpson index
1	*Lannea coramandelica*	11.11	11.11	40.72	62.95	0.0123
2	*Pterospermum aceroides*	22.22	22.22	14.16	58.61	0.0494
3	*Aglaia andamanica*	22.22	22.22	2.99	47.44	0.0494
4	*Salmalia insignis*	11.11	11.11	22.01	44.23	0.0123
5	*Dipterocarpus griffithii*	11.11	11.11	7.26	29.48	0.0123
6	*Champeria manillana*	11.11	11.11	2.11	24.33	0.0123
7	*Dysoxylum arborescens*	11.11	11.11	1.39	23.62	0.0123
8.	*Oxytenanthera nigrociliata*	91.00	50.0	9.35	150.35	0.0034

The data collected from the above said forest were analysed and resulted for girth class wise total species and individuals and percent to the total. It was clearly noted that, the minimum girth class starts with above 30 cm gbh. Also, most of the measured individuals fall

under this category (94%) is mostly bamboos. The remaining tree species fall only in four girth class intervals viz., 60-90, 90-120, 120-150 and 150-180 cm gbh and no trees were found/fall beyond the girth class. Even in the girth class above 90 cm gbh, only few trees were recorded or presents in the particular forest type because its nature (Table-3 and Fig-1).

Table-3. Population density of tree species across girth class intervals

Wet Bamboo Brakes				
S. No	**GBH Class**	**Species**	**Individuals**	**Percent to the total**
1	<30	-	-	-
2	30-60	3	94	94.00
3	60-90	2	2	2.00
4	90-120	1	1	1.00
5	120-150	1	1	1.00
6	150-180	2	2	2.00
7	180-210	-	-	-
8	210-240	-	-	-
9	240-270	-	-	-
10	270-300	-	-	-
11	>300	-	-	-

Fig-1: Population density of tree species across girth class intervals.

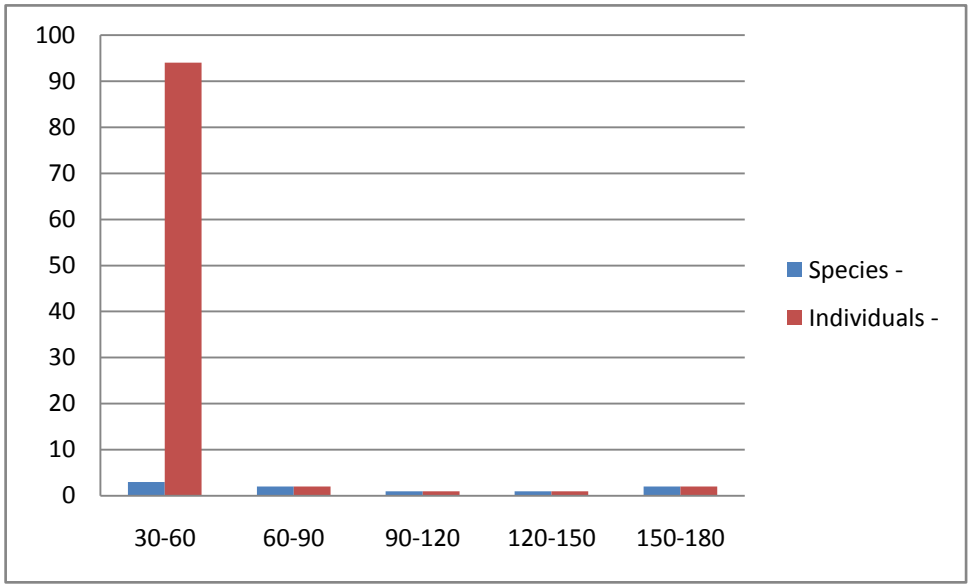

Table-4: Family wise species distribution in the wet bamboo breaks.

Wet Bamboo Brakes (2E2)		
Family	**Species**	**Total individuals**
Lannea coramandelica	Anacardeaceae	1
Salmalia insignis	Bombacaceae	1
Dipterocarpus griffithii	Dipterocarpaceae	1

Aglaia andamanica	Meliaceae	2
Dysoxylum arborescens		1
Champeria manillana	Opiliaceae	1
Pterospermum aceroides	Sterculiaceae	2
Oxytenanthera nigrociliata	Graminaceae	91

In the case of species and individuals distribution family wise stated that, Graminaceae family registered more number of individuals (91) followed by Meliaceae (3). Families like Meliaceae were registered only one individual. Among the families, Meliaceae registered more species diversity within the family (2 species) followed by other families registered mostly one species and rarely two species (Table-4).

Discussion

Through the use of the subset of tree individuals, 100 individual stems representing 8 families with 8 genera. The Shannon-Weiner index (H') for the above forest was 0.473 but varied from 0.046 to 0.086, with Simpson's value of 0.0229. These values infer that, the Andaman wet bamboo breaks are having less species diverse systems. There is no surprise that, this particular forest type with low diversity due to presence of bamboo clumps. But, interesting point here is occurrence of other tree species i.e. almost 9 individuals in one ha area represents these kind of wet bamboo breaks are on their own way towards their natural habit i.e. changing over to other forest type.

The mean stand density of 1111.11 stems ha^{-1} in the forests because of presence of more culms in the clumps and is well within the range of wet bamboo breaks. This is in tune with the Murali *et al*., (1996), Sundarapandian and Swamy (1997) and Ghate *et al*., (1998) in the tropics. This range of stand density in the present study is higher when compared to other forests (Kaduvul and Parthasarathy, 1999a, b; Chittiibabu and Parthasarathy, 2000; Jayakumar *et al*., 2002; Natarajan *et al*., 2004).

In terms of overall ecological dominance within the forest type, the high importance value species (IVI) is *Oxytenanthera nigrociliata* (150.35) followed by *Lannea coramandelica* (62.95).

In the tropical rain forest, the range of tree species count per hectare s about 20 to a maximum of 223 (Parthasarathy and Sethi, 1997). In the present study and analysis showed a maximum of 67 tree species per hectare has been recorded in the Andaman wet bamboo breaks. The present study also supports the fact that Graminaceae, Sterculiaceae, Opiliaceae, Dipterocarpaceae, Bombacaceae, Anacardeaceae and Meliaceae are the dominant families in the particular forest except in the mangrove (Padalia *et al*., 2004).

In the present study, it is observed that species diversity is positively correlated with the taxonomical studies. Most of the trees species shows random distribution.

Stem density and species richness have consistently decreased with increasing girth class of tree species from more than 60 cm gbh. Species number gradually decreases with the fall in the count of stems in higher girth class category (Table-3, Fig-1). Girth class having >30 cm gbh contributed to about 94% of the species richness.

Girth class frequency showed J-shaped population structure of trees exhibited in

the forests is in conformity with other forest stands.

Conclusions

Calculations of IVI have helped in understanding the ecological significance of the species in the wet bamboo breaks type in North Andaman. Species diversity and stem diversity were observed to decrease with increasing girth class. The variability in rainfall and distinct terrains of the site has resulted in unique species in terms of species diversity and endemism. It is concluded that, Andaman forests are still rich in tree species diversity, even after the small disturbance by nature and extraction of economic species. Priority should be given to these types of forests for sustaining the same diversity. The attention on people's participation is most essential for effective conservation. The present study will serve as a primary input towards monitoring and sustaining the phyto-diversity of Andaman wet bamboo breaks forest type in North Andaman.

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Diversity of macro-fungi in Central India-XIX: *Humaria hemisphaerica*, a cup fungus

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Abstract

The present article reports an ascomycetous cup fungus, *Humaria hemisphaerica* occurring on bark of mature branches of living and mature tree of *Madhuca latifolia*, in Mandla district of Madhya Pradesh. Previously it was reported on dead twigs and soil under *Cedrus* forest, Mussoorie, Uttarakhand.

Introduction

Humaria hemisphaerica (F.H. Wigg.) Fuckel was established by Fuckel (1870). It is included in an artificial group called 'cup fungi'. The group 'cup fungi' is not a very scientific term, but it holds together many mushrooms that are shaped more or less like cups, saucers, or goblets. These are cup-shaped mushrooms and very diverse, comprising of several different families and 22 genera namely, *Aleuria, Aleurodiscus, Bisporella, Bulgaria, Cheilymenia, Chlorociboria, Disciotis, Galiella, Gyromitra, Helvella, Hymenoscyphus, Humaria, Jafnea, Microstoma, Otidea, Pachyella, Peziza, Sarcoscypha, Sarcosphaera, Scutellinia, Tarzetta* and *Urnula* and most of them are placed in the Ascomycetes. Some cup fungi can be easily identified, but many are extremely difficult, requiring microscopic analysis. Fortunately most cup fungi are fairly simple in construction, which means that there are not a lot of features to assess--even under the microscope. Recently two such fungi, *Helvella latispora* and *Cheilymenia jabalpurensis* were reported from central India (Tiwari et al., 2013; Verma, 2017).

The present article report *Humaria hemisphaerica* occurring on bark of mature branches of living and mature tree of *Madhuca latifolia* from Mandla, Madhya Pradesh, which constitute a new fungal record from central India.

Materials and methods

Specimen was collected from Mandla, Madhya Pradesh. Identification of fungus was done with the help of literature (Cash, 1948; Denison, 1959, 1964; Dennis, 1968; Dissing, 1981; Elliott and Kaufert, 1974; Ginai, 1936; Korf, 1954; 1960; Pfister, 1979; Ramamurthi et al., 1957; Seaver, 1928; Seaver, 1942; Tewari and Khare, 1969; Thind et al., 1957; 1959a; Thind and Sethi, 1957a, b; Thind and Singh, 1959; 1960a; Thind and Waraitch 1971a; Weberet al., 1997; Yao and Spooner, 1996; 2002; Zhuang and Korf, 1986; Waraitch, 1976, 1977) and matter available on net. The slides were prepared in lacto-phenol and cotton blue and observed under advance Research Microscope, make Leica, Germany and photomicrographs were taken with a digital camera attached to the microscope.

Results

Taxonomic Description

***Humaria hemisphaerica* (F.H. Wigg.) Fuckel (Figures 1-3)**

≡ *Peziza hemisphaerica* F.H. Wigg.

=*Patella albida*
=*Humaria hemispherica* (without the '*a*') are synonyms.
(Pyronemataceae, Pezizales, Pezizomycetidae, Pezizomycetes, Pezizomycotina, Ascomycota)
Fruiting Body goblet shaped when young, becoming more broadly cup-shaped and reaching widths of 2-3 cm when mature; upper surface white or pale bluish, fairly smooth; undersurface densely hairy with prominent hairs that extend above the margin of the cup, brown; without a stem; odor none; flesh brownish or pale, brittle. Ascospores measuring, 20-24 x 10-12µm; elliptical, often with somewhat flattened ends; usually with two oil droplets that break up at maturity; smooth in KOH, but warty or roughened-asperulate in Melzer's reagent. Asci eight-spored; tips not bluing in Melzer's reagent. Paraphyses filiform with clavate apices; hyaline in KOH; septate. Hairs brown in KOH; frequently septate; smooth; thick-walled; 7.5-12.5 µm wide; apices sharpened to a point.

Collection examined

On bark of woody branches of mature living tree of *Madhuca latifolia*, Maravaru, Mandla, Madhya Pradesh, 16/02/2013.

Fig. 1: *Humaria hemisphaerica*: Habit on branch of living tree of *Madhuca latifolia*


Figs. (2-3): *Humaria hemisphaerica*: cup shaped fruit bodies

There are 19 species of cup fungi were reported from India. Most of these fungi were reported from Mussoorie, Uttarakhand (12 species). One species each was reported from Dehra Dun, Garhwal, Jammu and Kashmir, Punjab, Rohtak and Varanasi (Table 1).

Table 1: Diversity and distribution of Humaria species in India

SN	Name of fungus	Habit	Distribution	Reference
1.	*Humaria aurantia* (Clem.) Häffner, Benkert & Krisai =*Scutellinia aurantia* (Clem.) Waraitch	On rotten pieces of coniferous wood and much humicolous soil, under *Cedrus deodara* forest	Patni Top, Udhampur, Jammu and Kashmir	Waraitch (1977)
2.	*Humaria carpophila* (Bizz.) Sacc. ≡*Peziza carpophila* Bizz.	from dung of buffalo	Punjab	Ginai (1936)
3.	*Humaria cookeana* Seaver =*Hymenoscyphus cookeanus* (Seaver) V.P. Tewari & K.B. Khare	-	Varanasi, UP	Tewari and Khare (1969)
4.	*Humaria cubensis* (Berk. & M.A. Curtis) K.S. Thind & J.S. Sethi ≡*Peziza cubensis* Berk. & M.A. Curtis	on rotten wood, on soil under *Cedrus deodara* forest	Mussoorie, Uttarakhand	Thind and Sethi (1957a)
5.	*Humaria gerardii* var. *gigantea* K.S. Thind & Pr. Singh	on humicolous soil under oak forest	Mussoorie, Uttarakhand	Thind and Singh (1959)
6.	*Humaria glareosa* (Velen.) K.S. Thind & J.S. Sethi	on soil	Mussoorie, Uttarakhand	Thind and Sethi (1957b)
7.	*Humaria gregaria* Rehm	on soil amid mosses under *Cedrus* forest	-	Thind and Sethi (1957a)

8.	*Humaria haemastigma* (Hedw.) Massee ≡*Lamprospora haemastigma* var. *gigantea* K.S. Thind & Pr. Singh,	-	Mussorie, Uttarakhand	Thind and Singh (1959)
9.	*Humaria hemisphaerica* (F.H. Wigg.) Fuckel ≡*Peziza hemisphaerica* F.H. Wigg.	on dead twigs and soil under *Cedrus* forest and old branch of *Madhuca latifolia*	Mussoorie, Uttarakhand and Mandla, Madhya Pradesh	Thind and Sethi (1957a) This article
10.	*Humaria irregularis* (Clem.) K.S. Thind & Waraitch ≡*Scutellinia irregularis* Clem. =*Patella irregularis* (Clem.) Seaver	-	-	Thind and Waraitch (1971)
11.	*Humaria masseeana* Sacc. & D. Sacc.	-	Garhwal, Uttarakhand	Butler and Bisby (1931)
12.	*Humaria mussooriensis* K.S. Thind, E.K. Cash & J.S. Sethi	on the soil under coniferous forest	Mussoorie, Uttarakhand	Thind et al. (1957)
13.	*Humaria orthotricha* (Berk. & M.A. Curtis) Sacc. ≡*Peziza orthotricha* Berk. & M.A. Curtis	on dead stem of *Trewia nudiflora*	Dhanolti, Mussoorie, Uttarakhand	Thind et al. (1957)
14.	*Humaria pallidisetosa* E.K. Cash =*Tricharina pallidisetosa* (E.K. Cash) K.S. Thind & S.C. Kaushal	on the ground	Rohtak, Haryana	Cash (1948)
15.	*Humaria pygmaea* (Clem.) K.S. Thind & J.S. Sethi	on soil under *Cedrus* forest	Uttarakhand	Thind and Sethi (1957b)
16.	*Humaria scutellata* Fuckel	on dead wood and dead twigs and on dead wood of *Cedrus deodara*	Dehra Dun and Mussoorie, Uttarakhand	Thind and Sethi (1957a)
17.	*Humaria* sp.	on dead foliage of *Cupressus* sp.	Mussoorie, Uttarakhand	Thind and Singh (1960a)
18.	*Humaria stercorea* Fuckel	on buffalo dung	Mussoorie, Uttarakhand	Thind and Singh (1959)
19.	*Humaria subreticulata* K.S. Thind, E.K. Cash & Pr. Singh	on soil amid mosses	Mussoorie, Uttarakhand	Thind et al. (1959a)

Maximum diversity of species was shown by *Hymenoscyphus* followed by *Peziza* and *Humaria*. Genera of cup fungi like, *Chlorociboria*, *Disciotis*, *Galiella*, *Gyromitra*, *Jafnea* and *Pachyella* are less common and represented by only one species in India while *Microstoma*, *Sarcosphaera* and *Urnula* are not reported from India (Table 1, 2).

Table 2: Cup fungi reported from India

S.N.	Name of genus	Number of species reported from India
1.	*Aleuria*	10
2.	*Aleurodiscus*	4
3.	*Bisporella*	4
4.	*Bulgaria*	3
5.	*Cheilymenia*	12
6.	*Chlorociboria*	01
7.	*Disciotis*	01
8.	*Galiella*	01
9.	*Gyromitra*	01
10.	*Helvella*	16
11.	*Humaria*	20
12.	*Hymenoscyphus*	50
13.	*Jafnea*	01
14.	*Microstoma*	00
15.	*Otidea*	09
16.	*Pachyella*	01
17.	*Peziza*	38
18.	*Sarcoscypha*	03
19.	*Sarcosphaera*	00
20.	*Scutellinia*	10
21.	*Tarzetta*	03
22.	*Urnula*	00
	Total	**188**

Discussion

Cup fungi comprising of 22 genera are mostly known to occurred in northern India and till date 188 species are reported (Table 2). Most of species are reported from Uttarakhand (Butler and Bisby, 1931; Cash, 1948; Thind et al., 1957; Thind and Sethi, 1957 a, b; Thind and Singh, 1959, 1960; Thind et al., 1959). *Humaria aurantia* was reported from Jammu and Kashmir (Waraitch, 1977). *H. carpophila* was reported growing on dung of buffalo in Punjab (Ginai, 1936) while *H. cookeana* was reported from Varanasi, UP (Tewari and Khare, 1969) and *H. pallidisetosa* was reported from Rohtak, Haryana (Cash, 1948).

Humaria species have worldwide distribution and reported from Gaul, Western Europe (France and Belgium), Sweden, Britain, Dania (Côte d'Ivoire), Italy, Russia, Bavaria (Germany), Belgium, Hungary, America (Denison, 1959, 1964; Dennis, 1968; Dissing,1981; Elliott and Kaufert, 1974; Korf, 1954; 1960; Pfister, 1979; Ramamurthi et al., 1957; Seaver, 1928; Seaver, 1942; Weberet al., 1997; Yao and Spooner, 1996; 2002; Zhuang and Korf, 1986). From India *Humaria hemisphaerica* was reported growing on soil under *Cedrus* from Mussoorie, Uttarakhand ((Thind and Sethi, 1957a). It was widely distributed, growing on soil and, less frequently, on

well rotted wood. In the present article it was recorded growing on dead bark portions of *Madhuca latifolia* tree.

This cup mushroom is commonly known as the hairy fairy cup or the brown-haired fairy cup. It reaches a width of 2 or 3 cm. It has a whitish or pale bluish upper surface, and a brown outer surface that is entirely covered with stiff, brown hairs. Most other 'eyelash cups' are either brightly colored, or are smaller but species of *Jafnea*, in eastern North America, are superficially similar. Some species of cup fungi, for example, *Sarcosphaera* were also ectomycorrhizal with trees.

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Role of kairomones in integrated pest management

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Introduction

Kairomone is a semiochemical, emitted by an organism, which mediates interspecific interactions in a way that benefits an individual of another species which receives it, and harms the emitter. This "eavesdropping" is often disadvantageous to the producer (though other benefits of producing the substance may outweigh this cost, hence its persistence over evolutionary time). The kairomone improves the fitness of the recipient and in this respect differs from an allomone (which is the opposite: it benefits the producer and harms the receiver) and a synomone (which benefits both parties). The term is mostly used in the field of entomology (the study of insects). Two main ecological cues are provided by kairomones; they generally either indicate a food source for the receiver, or the presence of a predator, the latter of which is less common or at least less studies.

The seminal role of chemical ecology in regulating the attacks of insect pests on cultivated plants was delineated by Fraenkel in 1969, there can hardly be an entomologist today who does not know that host selection is the very heart of agricultural entomology and that secondary plant substances are the clues to the problem. Twenty-five years later we can state with conviction that progress in integrated pest management (IPM) will be closely meshed with the use of semiochemicals that modifyinsect behavior. These semiochemicals include pheromones that regulate intraspecific communication of alarm, aggregation, trail-following and mating behavior and kairomones that regulate interspecific communication of appropriate host selection for feeding, oviposition and shelter.

For use in insect control, semiochemicals have the important advantages of physiological and ecological selectivity, and often of extremely high biological activity (expressed in picograms to nanograms at the target antennal receptor site). Appropriate uses for semiochemicals in insect pest management include (a) monitoring for pest density in relation to the economic threshold (b) detection of outlying infestations (c) mass removal trapping (d) incorporation as attractants and phagostimulants in toxic baits or trap crops and (e) adverse modification of sexual or social behavior.

Role of kairomones in IPM.

The preponderance of semiochemical research and development for insect control relates to the use of sex pheromones. There has been little appreciation in recent literature of the possible uses of host kairomones important in hostselection and feeding stimulation (phagostimulants). However, the first identification of an insect behavior modifying chemical was Howlett's characterization in 1915 of the plant kairomone methyl eugenol as an attractant

for male fruit flies *(Dacus diversus, D. zonatus* and *D. dorsalis)*. This discovery antedated the first identification of an insect pheromone bombykol of the female silkworm moth, *Bombyx mori,* by 44 years. Geraniol, a volatile kairomone attractant for the Japanese beetle, *Popillia japonica*, was patented by Smith *et al.* in 1926. In 1935, Riley and Hepburndemonstrated that terpineol acetate from a variety of essential oils was a specific attractant for the male Mediterranean fruit fly, *Ceratitis capitata,* and for the Natal fruit fly, *Ceratitis rosae*.

Robust IPM technology has emerged from these discoveries in the employment of methyl eugenol and raspberry ketone for the monitoring of incipient infestations of several hundred species of Dacini fruit flies, including the oriental fruit fly, the Queensland fruit fly, *Dacus tryoni,* and the melon fly. The 'male annihilation' technology developed by Steiner *et al.* in 1965 has led to the use of these kairomonelures in multiple-source toxic baits for the complete control and even eradication of these fruit flies in insular infestations.

The extensive investigations of kairomone attractants for the Japanese beetle by the U.S. Department of Agriculture have resulted in the development of synergistic lure combinations such as geraniol, eugenol and phenethyl propanoate, presently used in hundreds of thousands of simple 'bag traps' for the control of this insect in suburban and isolated locations. The three lure components are widely distributed among the very large host plant resources of the Japanese beetle. Investigations of kairomone lures for the Mediterranean fruit fly have identified the terpenoid ot-copaene from *Archangelica officinalis* as an exceptionally active lure, attractive to males at dilutions as low as 1 ppb. Angelica oil containing ct-copaene has been used to monitor incipient infestations ofthe Medfly since 1957. Thus, the employment of kairomone lures for insect control was solidly established well before the potentialities of pheromones became evident.

More recent milestones in kairomone technology include the identification of the tetracyclic triterpenoids cucurbitacin B and cucurbitacin E from bitter Cucurbitaceae, as phagostimulants for the Chrysomelidae beetles, Aulacophorini and Diabroticini.

The incorporation of these phagostimulants in 'attracticide' baits has produced specific control of adult rootworms when applied at about 1-2 g of cucurbitacin and 10-20 g ofinsecticide per ha. It has shown that the plant kairomone hypericin from *Hypericum* spp. is a powerful phagostimulant for many species of *Chrysolina* beetles, explaining the remarkable effectiveness of these beetles as biological control agents for the control of the rangeland weed *Hypericum perforatum.* In an analogous way, the identification of 1-octene-3-ol as a powerful kairomone attractant for the tse-tse flies, *Glossina* spp., has revolutionized the control of these vectors of African trypanosomiasis. Recent identification of oviposition kairomones for *Heliothis* budworms and the sweet potato weevil, *Cylas formicarius*, may provide other avenues for the exploitation of kairomone technology.

Parakairomones as lures.

Parakairomones are structurally optimized analogs of natural kairomones with similar behavior-modifying properties. In general, the semiochemical structural limitations for insect receptor depolarization are less rigorous for kairomones than for pheromones. Parakairomones may have

simpler chemical structures than natural kairomones and are therefore cheaper to produce. For example, trimedlure or tert-butyl4-(or 5)-chloro-2-methylcyclohexane carboxylates, widely used in monitoring for Medfly infestations, is a parakairomone of tx-copaene.Parakairomones may have more favorable physical and chemical properties than natural kairomones. Thus, the parakairomone cue-lure or (4-p-acetoxyphenyl)-2-butanone is about 17-fold more volatile than the kairomone raspberry ketone of (4-hydroxyphenyl)- 2-butanone and is a more effective lure for the melon fly, although raspberry ketone ismore persistent. Similarly, the Japanese beetle lure, phenethyl propanoate, is a parakairomone of the natural kairomone phenethanol, and 4-methoxycinnamonitrile is a parffkairomone of the lure for the western corn rootworm, 4-methoxycinnamaldehyde. Parakairomones may have more favorable toxicological properties than kairomones; for example, the parakairomone of the oriental fruit fly, 3,4-dimethoxy-1-propylbenzene, as compared with the kairomone methyl eugenol or 3,4-dimethoxy-1- allybenzene. Thus, parakairomones may have important roles in IPM.

The role of kairomones in host selection by insect pests is highly rewarding in furthering the basic and applied aspects of IPM. Kairomone attractants already provide inexpensive lures for more than 300 insect pests. Combining these lures with disposable traps provides the simplest means for monitoring incipient pest infestations in geographically isolated areas and for quantitative estimation of pestpopulations to evaluate economic thresholds for pest control. Kairomone lures are presently used in millions of 'removal traps' to control low level pest infestations, as for fruit flies, scarab beetles and tse-tse flies. Incorporation of volatile kairomone lures and kairomone arrestants and phagostimulants into bait sprays and granulars, 'twist-ties', and fiberboard squares, containing minimal quantities of insecticides -- can provide areawide insect control free from hazards to beneficial insects and pollinators. This use of 'attracticides' can reduce the amount of insecticide applied to as little as 1% of that required for conventional sprays, and thus almost eliminate the hazards of insecticide residues on edible produce. Attracticides have exceptional promise for exposing insect pests to insect growth regulators and to microbial insecticides. Knowledge of thechemical ecology of kairomones present in cultivars provides elegant opportunities for selective plant breeding to remove host attractants from the cultivars. This antixenotic approach has already been shown to be effective in the amelioration of herbivory of Cucurbitaceae devoid of cucurbitacin phagostimulants for *Luperini* beetles (Diabroticitesand Aulacophorites) and of *Hypericum* spp. devoid of hypericin phagostimulants for *Chrysolina* beetles. The most rewarding product of kairomone research however may well be the fundamental insights that it provides about insect behavior and the coevolution of plants and insects.

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Heavy outbreak of poplar defoliator in Kaza (Spiti) wildlife sanctuary (Himachal Pradesh)

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Poplar, by virtue of their fast growth, offer a great potential for meeting the requirements of the farmers and wood based industries in the country. During recent past, many clones of *Populus deltoides* and *P. xeuramericana* hybrids have been introduced into the country. Besides the exotic poplar, *P. ciliata*, an indigenous poplar is being raised in pure plantations or in mixture with some exotic poplar in Himachal Pradesh. Poplar is attacked by large number of pathogens in nurseries and plantations, which result in the reduction of biomass. Although the occurrence of various poplar diseases has been reported from different parts of the country. Poplars and willows belong to the family Salicaceae and originate from temperate regions of the Northern Hemisphere. Some 300 species of willows and 40 species of poplars are known. Both genera are readily propagated from cuttings or large poles and this can lead to extensive monoclonal plantings which are vulnerable to newly introduced pathogens. The genera *Populus* and *Salix* - commonly known as poplars and willows - offer an extraordinary variety of possible products and thus are extremely useful in forest development. In addition, many of their species are easy to hybridize and propagate from cuttings, so that they lend themselves to the kind of genetically improved growth and disease-resistance more commonly associated with agricultural and horticultural crops than with forest tree species

About the area and mortality in Poplar

The green cover in the picturesque hills of in the Kaza wild life Forest Range of Himachal Pradesh is under serious threat, as large scale drying of poplar trees is occurring due to some mysterious problem which was later identified. The area was visited and it was observed that large scale drying and mortality of Poplar Trees in surrounding areas of the Kaza valley was occurring due to some biotic or abiotic pressures. Large scale drying of poplar trees is noticed in the Kaza wild life Division, Kaza (Distt. Lahaul & Spiti). The area is covered with Poplar trees along with other trees and shrubs etc. Polar trees in the premises of DFO office and nearby adjoining areas were found drying/dying due to both biotic and abiotic reasons. Some of the trees were also dying due to this heavy attack of insect-pests. It was recorded that Poplar trees were drying due to these problem for 5-6 years back and this problems has reached the alarming stage as visible during the spot visit. Many dead trees of poplar were removed by

State Forest Department during 2010 from this area due to the same problem.

Review of the Problem

Populus ciliata Wall. ex Royle, an indigenous poplar species is widely distributed in the temperate Himalayas from Kashmir to Arunachal Pradesh between 1,300 to 3,500 m above sea level and reported to be heavily present in nurseries, plantations and natural forests. Apart from indigenous species, exotic hybrids and species of Populus, namely *P. nigra* L. (cv. Italica), *P. deltoides* Marsh., *P. euramericana* (Dode) Guiner, P. yunnanensis L., *P. alba* L. and *P. tremula* L. are grown in India and all are susceptible to *M. ciliata* with varying degrees. The poplar trees are very much prone to insect-pest and disease attack. Ahmad (1993) studied relative resistance in different clones of *Populus deltoides* to poplar defoliator *Clostera cuperata (*Lepidoptera: Notodontidae). Further, Ahmad *et. al.* (2001) reported Insect pest spectrum of poplar in India. Chatterjee and Mishra (1974) recorded natural insect enemy and plant host complex of forest insect pests including those attacking the poplars of Indian region. Kapoor *et. al* (1994) evaluated different insecticides against poplar shoot borer *Eucosma glaciata* Meyrick (Lepidoptera: Eucosmidae) in Himachal Pradesh.

Field Observations

After intense survey of drying trees, it was found that Poplar trees were drying and dying due to attack of defoliator and borer. Some trees were drying from the top (Dieback symptom) and heavy defoliation was also being observed. Samples of soil, stem, leafs also brought to the laboratory for further studies. Adult moth (defoliator), larvae & adult of borer also brought to the lab for studies. Spot examination reveals that some popular trees were heavy attacked by a defoliator with prominent symptoms of attack as visible on leaves, which was identified as *Anarsia lineartella* (Gelechidae: Lepidoptera). Earlier, Kumar *et. al.* (2016) has highlighted the importance of various morphological characters in identification of Lepidoptera. Literature reveals that this insect and related species mainly feed on the fruits like apricot, peach, plum etc. and over a period of time it may have adaptited well on this new host in the cold desert area. The same problem was noticed in the popular plantations in Leh (Ladakh). It was also observed that numbers of plants have lost complete foliage and was nearly dead. In some trees the leaves were becoming yellowish and brownish, were also drying. Leafless trees were scattered throughout the area. According to the wild life officials the problem has gained momentum three-four years back the problem has vigorously increased. The problem was prevalent on the poplar plantations all over the Kaza. Another insect which was causing damage to the tree was a stem borer (the ground beetle) belonging to the order Coleoptera. This beetle was observed feeding the stem at the bottom of the tree and it was found that stem was highly damaged near the bottom as this bore enters the stem from the soil. It was also observed that trees were also susceptible to fungal attack and certain fungal species were found attacking the popular trees. The attack of insects and pathogens including both the insect species *i.e* stem borer and defoliator were feeding extensively on stem and leaves respectively and causing the drying and mortality of the trees. The fragile ecological conditions were adding to the problem. Long term study on both biotic

(insect-pests and diseases) and abiotic (ecology) factors is required immediately for developing effective management practices against the problem.

The symptoms shown by the tree observed during investigation are as follows:

1. Leaves of affected trees were dwarf, yellowish, brownish and ultimately drying.
2. Early defoliation i.e. leaves falling prematurely.
3. Tree showing dieback symptoms.
4. Every affected tree was drying from top to bottom, leafs, twigs as well as branches following the same trend.
5. The roots were showing clear symptoms of attack.

Spot examination reveals that some Poplar trees were heavy attacked by a defoliator with prominent symptoms of attack as visible on leaves, which was identified as *Anarsia lineartella* (Gelechidae: Lepidoptera). Literature reveals that this insect and related species mainly feed on the fruits like apricot, peach, plum etc. and over a period of time it may have adapted well on this new host in the cold desert area. The same problem was noticed in the Poplar plantations in Leh (Ladakh). It was also observed that numbers of plants have lost complete foliage and was nearly dead. In some trees the leaves were becoming yellowish and brownish, were also drying. Leafless trees were scattered throughout the area. According to the wild life officials the problem has gained momentum three-four years back the problem has vigorously increased. It was felt that extensive studies on the problem and immediate control measures needs to be applied on the trees to prevent the further escalation of Poplar trees dying.

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सामाजिक एवं *लाभकारी कीट*

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परिचय (Introduction)

कीटों द्वारा की जाने वाली परागण (Pollination) क्रिया अधिकतर पौधों और जंतुओं के जीवन का आधार है। कीट न केवल पर्यावरण के स्थायित्व के लिए अन्य घटकों के साथ संतुलन (Balance) बनाए रखते हैं अपितु इसके व्यवस्थापन में भी इनकी भागीदारी अत्यंत महत्वपूर्ण है। पर्यावरण को सुरक्षा प्रदान करने में लाभकारी कीटों का स्थान अग्रणीय है। ये कीट विभिन्न प्रकार से मानव एवं अन्य जीव प्रजातियों के लिए उपयोगी हैं। इन कीटों के बिना स्वस्थ वनों का अस्तित्व कल्पना मात्र ही होगा। प्राचीन युग से ही अस्तित्व में रहने वाले विश्व में सर्वाधिक महत्वपूर्ण प्रजातियों में शुमार कीटों की लगभग 6,40,000 जातियों में से 10,000 जातियाँ ही क्षति पहुंचाती हैं। कीटों का अध्ध्यन कीट विज्ञान (Entomology) कहलाता है। आर्थिक कीट विज्ञान (Economic Entomology) के अन्तर्गत लाभदायक और हानिकारक कीटों के महत्व (importance/ values), नियंत्रण (control mreasures), विस्तार (Extension) और अधिमूल्यन (Appreciation) को सम्मिलित किया जाता है। सन 1735 में महान वैज्ञानिक लीनियस ने इनका वर्गीकरण किया।

अप्रष्ठवन्शियों (Invertebrates) के इन संधिपाद (Hexapoda) कीटों का शरीर सिर, वक्ष और उदर में विभाजित होता है। तीन जोड़े पैर तथा ग्रहणशील एंटिना होते हैं। संयुक्त नेत्र परंतु सरल नेत्र भी पाये जाते हैं। परिवर्धन (Development) (डिंभ- प्यूपा- वयस्क) साधारणतयः रूपान्तरण (Metamorphosis) द्वारा होता है। रूपान्तरण वृद्धि डिंभ / निंफ से (Growth), भेदीकरण प्यूपा से तथा प्रजनन (Reproducion) वयस्क से प्रदर्शित होता है। आर्थोपोडा के षटपाद वर्ग इन्सेक्टा (कटे हुए) के ये कीट ध्रुवों से ले कर मध्यभाग, शीतोष्ण से उष्ण, हिमाच्छादित से जलीय स्थानों, तीक्ष्ण दुर्गन्ध, (पैट्रोलियम के कुओं में पाया जाने वाला साइलोसा पैट्रोली) अथवा आवासीय स्थानों, बहुत गर्म (+40 ^{0}C) अथवा ठण्डे क्षेत्रों (-50 ^{0}C), प्रकाशीय या ढँकी हुई जगहों, सुरंगों, पेड़-पौधों, वृक्षों की छाल, सड़े गले स्थानों, मिट्टी, पत्थर हर जगह ये स्वतंत्र या परजीवी के रूप में पाये जाते हैं। कीटों का पाया जाना अनुकूल परिस्थितियों पर बहुत निर्भर करता है जिनमें पोषक तथा पर्यावरणीय दशायें मुख्य घटक हैं। कुछ कीट (जैसे तितली एवं टिड्डियाँ) भोजन की तलाश में अपने स्थान से दूर दूसरे देशों में भी चले जाते हैं। न्यूज़ीलैन्ड में पाया जाने वाला कीट (स्प्रिंग टेल) ने स्वयं को विपरीत परिस्थितियों के अनुसार ढाल कर अपने क्षेत्र को बढ़ा लिया लिया।

कीट संघ एवं व्यवहार (Insect association and behavior)

एक या अधिक जाति के कीटों का परस्पर संबंध (संघ) आवश्यकताओं की पूर्ति हेतु होता है। ये अल्पसमय से दीर्घ समयांतराल तक हो सकता है। कीटों का सामाजिक जीवन व्यतीत करना उनके भोजन, आवास, प्रजनन, विचरण तथा सुरक्षा हेतु महत्वपूर्ण है। यह घनिष्ठता एवं एकजुटता की ओर संकेत करता है। ये प्रकृति कभी कभी हानिकारक भी होती है। निष्क्रिय कीट संघ में

कुछ कीट वायु, जल, अथवा तरंगों के माध्यम से अपने पथ से भटककर अन्यत्र स्थानों पर पहुंच जाते हैं जो उनके लिये कठिनाई का कारण बनता है तथा कभी कभी इन्हें नष्ट भी कर देता है। साथ ही इन कीट पर आश्रित रहने वाले भक्षी कीटों के लिये यह लाभकारी सिद्ध होता है।

सक्रिय साहचर्य (Active companionship): कीटों (जैसे लेडी बर्ड बीटल) में विशेष परिस्थितियों (भोजन, निद्रा, मैथुन, समयानुरूप प्रतिकूल परिस्थितियों ग्रीष्मकालीन (Estivation) एवं शीतकालीन (Hibernation) स्थानांतरण, उड़ान के दौरान ही दल के रूप में होना पाया जाता है।

रक्षात्मक समूहन (Protective aggregation): कुछ कीट जैसे घूर्ण भृंग, तितली, मौथ, मक्खी, मच्छर, तितैया, मधुमक्खी, चींटी अपनी रक्षा हेतु भक्षक से बचने के लिए ग्रुप में रहते हैं।

प्रवाजी एवं दल समूहन: चींटियां सैन्य दल बनाकर गमन करने वाली (Migrating aggregation) जबकि सामान्यता मैथुन के उद्देश्य से दलों में भ्रमण करने और उड़ने वाले (Swarming aggreagtion) कीट मधुमक्खी, चींटी तथा दीमक इत्यादि होते हैं।

शयन समूह, पृथक्करण एवं एकांतप्रिय कीटः कुछ कीट जैसे क्षीर पाद तितलियाँ समूह बना कर सोती हैं (Sleeping aggregation) तो कुछ कीट भोजन के अभाव में झुंड से पृथक होकर (पृथक्करण) दूसरे स्थान को चले जाते हैं। मक्खी, मधुमक्खी तथा बर्र की कुछ प्रजातियाँ एकांतप्रिय (Solitary insects) होती हैं।

मृतभक्षी, भक्षी कीट एवं वाहकः थाइसोन्यूरा, कोलिओप्टेरा आदि के कीट मरे हुए तथा दूसरे आंशिक विघटित पदार्थों से भोजन प्राप्त करते हैं (Saprophagous insects) इसी प्रकार ओडोनेटा, प्लीकोप्टेरा, हाइमेनोप्टेरा के कीट भक्षी कीट (Predatory insects) होते हैं। कोलियोप्टेरा, लेपिडोप्टेरा, हेमोप्टेरा, थाइसेनोप्टेरा, डिप्टेरा तथा लिपीडोप्टेरा के कीट रोग एवं अन्य कारकों के वाहक (Carrier) होते हैं।

कीटों से लाभ (Benefits of Insects)

कीट वन, बग़ीचे तथा रोपणियों में नाशिकीटों को खाकर (उदाहरण के लिये लेडीबर्ड द्वारा एफिड एवं अन्य पतंगों को खाया जाना) अथवा अन्य प्रकार से पारिस्थितिक तंत्र को सुरक्षा एवं स्वास्थ्य प्रदान करते हैं जैसे किलर बग, टेकिनिडफ्लाई, ट्राइकोग्रामा, सोल्जर बीटल, इकन्यूमोन वास्प, ब्लास्टोफैगा कीट इत्यादि। बहुत से कीट परागण द्वारा गुणात्मक वृद्धि (मधुमक्खी, तितलियाँ) करते हैं, लाभदायक उत्पाद (जैसे एरिसेरस कीट द्वारा स्रावित चाइना मोम, लेसिफर या टेकार्डिया से लाख, मधुमक्खी से शहद, बौमिक्स मोराई से रेशम) तथा अन्य उपयोगी वस्तुएँ (टैनिन, रंजक, टर्की रेड) एवं औषधियाँ इत्यादि बनाते हैं। कुछ कीट जैसे जूं, टिड्डी, झींगुर, तिलचट्टा, चींटी, दीमक, तितैया, ड्रैगनफ्लाई, कुछ प्रजातियों के बीटल पोषक तत्वों की कमी को पूरा करने हेतु जीव जंतुओं (छिपकली, सर्प, मेंढक, पक्षियों तथा मनुष्य/जंजातियों) एवं पौधों (नेपेन्थीज़,ड्रोसेरा, स्टाइलीडियम) द्वारा भोज्य पदार्थों के रूप में उपयोग में लाये जाते हैं।

ड्रैगनफ्लाई हानिकारक मकड़ियों तथा मच्छरों की संख्या को नियंत्रित करने में उपयोगी सिद्ध हो सकती हैं। पर्यावरणीय परिवर्तन का सूचक एवं सुंदरता की प्रतीक तितलियाँ एक फूल से दूसरे फूल जाती हैं जिससे पौधे परागित होते हैं, नयी – नयी पौध जातियों का विकास होता है। कुछ पौधे परागण हेतु इन तितलियों पर निर्भर होते हैं। तितलियों से बना ये सौन्दर्य पर्यावरण न केवल सुखद अनुभूति देता है, बल्कि मन भी प्रसन्न करता है, इस प्रकार स्वास्थ्य के लिए भी लाभ कर होता है। पर्यावरण संरक्षण में इनका योगदान सराहनीय एवं अत्यंत महत्वपूर्ण है क्यूंकि तितलियाँ कीटनाशकों के लिए अति संवेदनशील होती हैं । गुच्छों के रूप में घोंसले बनाकर रहने वाली लाल चींटियां मिट्टी में वायु प्रवाह को संतुलित करती हैं। पर्यावरण को स्वस्थ एवं स्वच्छ बनाती हैं। हानिकारक कीटों को

खाकर पौधों और छोटे जीवों को सुरक्षा एवं सहायता प्रदान करती हैं। कृषि उपज जैसे कपास, गन्ने इत्यादि में लगने वाले हानिकारक कीड़ों को खाकर (प्राकृतिक कीट नाशक के रूप में) किसानों को लाभ पहुंचाती हैं

ध्वनि उतपन्न करने (Sonification) के कारण जापान के लोग सिकाड़ा एवं झींगुर का उपयोग मनोरंजन हेतु करते हैं। पुराने ज़माने में सौंदर्य आभूषण एवं श्रंगार वस्तुओं में कीटों की आकृति का उपयोग सामान्य बात थी। इसके साथ ही कीट पंखों, पैरों व कलाकृति में उपयोगिता इनके महत्व को दर्शाती है। जाति विशेष कीटों का उनके पोषक (आंशिक अथवा आश्रित पोषक) के रूप में खाद्य चयन पत्तियों, फल, फूल, छाल तथा रस (मकरंद) का उपयोग पारस्परिक संबंध का अच्छा उदाहरण है।

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संबंधित प्लेट्स:

Apis dorsata Fabricius, 1793 Order: Hymenoptera Family: Apidae	*Kerria lacca* Kerrr,1782 Order: Hemiptera Family: Kerriidae
 **1:** मधुमक्खी 'एपिस प्रजाति' के छत्ते	 **2:** लाख कीट 'केरिया लैक्का'
Canthecona furcellata Wolff, 1811 Order: Hemiptera Family: Pentatomidae	*Crocothemis servilia* Drury, 1773 Order: Odonata Family: Libellulidae

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कत्था उत्पादक खैर

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खैर का वृक्ष

खैर लेग्युमिनोसी कुल के उपकुल माइमोसेसी का सदस्य है। इसका वानस्पतिक नाम अकेशिया कटैचु है। इसके वृक्ष मध्यम ऊँचाई (08 से 10 फुट) के होते है जो पूरे भारत वर्ष में जैसे मध्य प्रदेश, उत्तर प्रदेश, पंजाब, बिहार, उडीसा, आसाम, बंगाल, गढवाल, कुमांउ आदि प्रदेशों में अत्यधिक आद्रता और अत्यधिक शुष्क स्थानों को छोड़ कर 1200 से 1300 मीटर की ऊँचाई तक पाये जाते हैं। इसकी छाल गहरे रंग की होती है। तरूण शाखाएं गहरे कत्थई रंग की होती हैं जिन पर कत्थई या काले रंग के चमकदार स्टीप्यूलर कांटे पाये जाते हैं। पत्तियाँ बाइपिन्नेट तथा पत्रक छोटे, रेखीय व वृन्त रहित होते हैं। वृन्त रहित पीले या क्रीम रंग के पुष्प कक्षीय स्पाइक पुष्प क्रम में लगे रहते हैं। इसकी तीन प्रजातियाँ अकेशिया कटैचु, अ. कटैचुआईडिस तथा अ. सुंदरा पायी जाती हैं। यह देखा गया है कि नदी - नालों के किनारे व इनके आसपास की भूमि पर खैर सामूहिक रूप से पाया जाता है।

जलवायु

खैर न्यूनत्तम तापमान 2.5 से 7.5 और अधिकत्तम तापमान 40 डिग्री से. से 50 डिग्री से. तथा 50 से 220 से.मी. वार्षिक वाले स्थानों पर वृद्धि कर सकता है। अधिक वर्षा व रेतीले भागों में भी इसकी वृद्धि देखी गयी है।

मृदा

खैर प्रायः सभी प्रकार की मृदा में जहाँ पानी का निकासी अच्छी तरह से होता है वृद्धि कर सकता है। परन्तु अधिकतर यह दोमट मृदा, रेतीली मृदा, बजरी युक्त जलोढ़ मृदा में पाया जाता है। बंजर व पथरीली मृदा में भी वृद्धि कर सकता है।

वृद्धि के लिए दशाएँ

खैर के पौधों की वृद्धि हेतु-

1. सूर्य का प्रकाश आवश्यक है, यह प्रकाश प्रेमी वृक्ष है। छाया में इसके पौधे मर जाते हैं।
2. यद्धपि यह मरूदभिद् प्रजाती है परन्तु अत्यधिक सूखा इसे मार देता है।
3. पौधे कोमल होते हैं अतः ठंड के मौसम में पाला पडने पर सूख जाते है।

फल

खैर की फल्लियाँ परिपक्व होने पर गहरे कत्थई रंग की हो जाती हैं। फल्लियों में 03 से 10 तक

बीज पाये जाते हैं। एक किलो ग्राम में 4500 से

खैर का पुष्पक्रम एवं फल्लियाँ

4700 तक फल्लियाँ आती हैं तथा 10 ग्राम में लगभग 40 से 45 बीज आते है।

बीजः खैर के बीज कत्थई रंग के तथा चपटे होते हैं । बीजों में 60 से 80 प्रतिशत तक अंकुरण पाया जाता है।

बीज प्राप्त करना

जब फल्लियाँ पूर्ण रूप से विकसित होकर परिपक्व हो गई हों परन्तु सूखी न हो तभी उन्हें वृक्षों की शाखाओं से एकत्र कर लेते हैं और धूप में सुखाते हैं। अच्छी तरह सूख जाने पर फल्लियों को लकडी के डंडे से अच्छी तरह पीटकर बीज अलग करते हैं और कचरा अलग कर उन बीजो को साफ सुथरा करतें हैं। पौध तैयार करने के लिए ताजे बीजों का उपयोग किया जाता है। क्योंकि भंडारण के दौरान कीड़े लग जाते हैं जिससे अंकुरण क्षमता प्रभावित हो जाती है एवं अधिक समय तक भंडारित बीजों की अंकुरण क्षमता समाप्त हो जाती है। खैर के वृक्षों में प्रति वर्ष प्रचुर मात्रा में फल उत्पादन होता है। इसलिए ताजे बीज आसानी से उपलब्ध हो जाते हैं।

बीज उपचार

अंकुरण हेतु बीजों के उपचार की कोई आवश्यकता नहीं होती है फिर भी यदि बीजों की बुआई पूर्व 24 घण्टें के लिए साधारण पानी में भिगोंकर रख दिया जाए तो एक साथ अधिक से अधिक बीज अंकुरित होते हैं।

रोपण हेतु पौध तैयार करना

खैर के बीजो को सीधे रोपण स्थल में बोया जा सकता है या रोपणी में पौध तैयार कर रोपण स्थल में पौधों को रोपा जाता है।

वृक्षारोपण स्थल में सीधे बुआई

खैर के बीजो को वृक्षारोपण स्थल में अप्रैल व मई माह में 30 से. मी. चौडी व 30 से.मी. गहरी खाइयाँ 04-04 मी0 के फासले पर खोदी जाती हैं। तेज धूप से खाइयों व मिट्टी का उपचार हो जाता है जिससे हानिकारक कीटाणु मर जाते हैं मिट्टी भुरभुरी हो जाती है। जून माह के अंत में खाइयों को मिट्टी से पूरा भरकर उन पर 15 से.मी. उँची मिट्टी चढ़ाकर मेढें बनाई जाती हैं तथा 04-04 मी. की दूरी पर बीज बोकर आवश्यकतानुसार सिंचाई करते हैं। प्रायः 07 से 10 दिन के अंदर बीज अंकुरित हो जाते हैं।

रोपणी में पौध तैयार करना

फरवरी माह में मिट्टी, रेत व गोबर की पकी खाद को बराबर मात्रा में मिलाकर मृदा मिश्रण तैयार किया जाता है। पोलीथीन की थैलियों को मृदा मिश्रण से भरकर प्रत्येक थैली में 02-02 बीज बोये जाते हैं। बीजों की बुआई पूर्व 24 घण्टें साधारण पानी में डुबाकर उपचारित करते हैं। पोलीथीन की थैलियों की आवश्यकतानुसार सिंचाई करते हैं। प्रायः 07 से 10 दिन के अंदर अंकुरण पूरा हो जाता है। जब पौधें 05 से 10 से.मी. तक लम्बे हो जाते हैं तब प्रत्येक थैली में 01 पौधा छोडकर अतिरिक्त पौधे निकाल देते हैं। वर्षा ऋतु आने तक पौधे 30 से 40 से. मी. तक लम्बें हो जाते हैं। अब इन पौधों को वृक्षारोपण स्थल पर अप्रैल व मई माह में तैयार किये गये 45

x 45 x 45 से. मी. माप के गड्ढों में लगाया जाता है। गड्ढों की मिट्टी में गोबर की पकी खाद मिलाकर गड्ढों को मिटटी से अच्छी तरह भर दिया जाता है और आवश्यकतानुसार सिंचाई कर दी जाती है। पौधे लगाते समय पोलीथीन की थैलियों को सावधानी पूर्वक अलग करना चाहिए जिससे जडों को नुकसान न पहुँचे।

पौध वृद्धि

पौधे सामान्य गति से वृद्धि करते हैं।

आवश्यक सावधानियाँ

1. प्रारंभ से ही पौधों को प्रचुर मात्रा में प्रकाश मिले।
2. पौधों के स्थापित होने तक 2-3 वर्ष तक समय-समय पर निंदाई-गुड़ाई की जाये। ताकि खरपतवार से पौधों को नुकसान न पहुँचे।
3. चूहे, सेही, सुअर आदि पशुओं से रक्षा के जाए।
4. आग से पौधों को बचाया जाएँ।
5. मृदा मिश्रण भली प्रकार तैयार किया जाये।
6. मिट्टी की बनाई गई मेढें दो वर्ष तक भुरभुरी बनी रहें।
7. प्रारंभिक वर्षों में पौधों को पाला व सूखा से काफी नुकसान पहुँचता है।

खैर की लकड़ी से प्राप्त कत्था

1. खैर की लकड़ी का सबसे अधिक उपयोग कत्था बनाने में किया जाता है। यह लकड़ी की हार्टवुड को बार-बार उबालकर प्राप्त किया जाता है तथा पान व औषधी निर्माण में काम आता है।

उपयोग

खैर के निम्नलिखित उपयोग हैं-

खैर की लकड़ी से प्राप्त कत्था

2. लकड़ी से हल व बैलगाड़ी के पहिये बनाये जातें हैं।
3. लकड़ी, औजारों और औजारों के दस्ते बनाने में काम आती है।
4. लकड़ी, धान कूटने का मूसल तथा तेल व गन्ना क्रशर (बीजों से तेल तथा गन्ने से गन्ना का रस निकालने हेतु) निर्माण में उपयोग की जाती है।
5. लकड़ी का उपयोग नाव की खील बनाने में किया जाता है।
6. लकड़ी का उपयोग ईधन के रूप में किया जाता है तथा इससे उत्तम प्रकार का कोयला प्राप्त होता है।
7. पत्तियाँ चारे के रूप में उपयोगी है।
8. उत्तम गुणवत्ता की पीली-सुनहरी गोंद का व्यापारिक महत्व है।
9. छाल चमड़ा रंगने के काम आता है।

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