Van Sangyan

Editorial Board

Patron: Dr. G. Rajeshwar Rao, ARS
Vice Patron: C. Behera, IFS
Chief Editor: Dr. R. K. Verma
Editor & Coordinator: Dr. Naseer Mohammad
Assistant Editor: Dr. Rajesh Kumar Mishra

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

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 770.69 km² 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 क्षेत्र और कल्याण उपायक क्षेत्र.

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
Statement of Responsibility

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

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

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

<table>
<thead>
<tr>
<th>No.</th>
<th>Title</th>
<th>Authors</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Structure and floristic composition of tree diversity in wet bamboo breaks of North Andaman, India</td>
<td>S. Saravanan</td>
<td>1</td>
</tr>
<tr>
<td>4.</td>
<td>Heavy outbreak of Poplar defoliator in Kaza (Spiti) Wildlife Sanctuary (Himachal Pradesh)</td>
<td>Pawan Kumar and Akhil Kumar</td>
<td>19</td>
</tr>
<tr>
<td>5.</td>
<td>सामाजिक एवं लाभकारी कीट</td>
<td>मंसूर अहमद एवं पी. बी. मेशाम</td>
<td>22</td>
</tr>
<tr>
<td>6.</td>
<td>क़ल्या उत्पादक खैर</td>
<td>ममता पुराचित, पृशिष्टालेख एवं राजेश कुमार मिश्रा</td>
<td>26</td>
</tr>
</tbody>
</table>
Structure and floristic composition of tree diversity in wet bamboo breaks of North Andaman, India

S. Saravanan
Silviculture, Forest Management and Agroforestry division
Tropical Forest Research Institute
(Indian Council of Forestry Research & Education, Ministry of Environment, Forests and Climate Change, Govt. of India)
RFRC (PO), Mandla Road, Jabalpur – 482021, Madhya Pradesh.
Email: saravanans@icfre.org

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° 06’ 02” N, 92° 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 m²/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° 06’ 02’’ N, 92° 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) = \(\text{p-(dbh/2)^2}\).

Relative density
= No. of trees of species/total number of trees of all species \times 100

Relative frequency
= No. of times species occurs/total number of species \times 100

Relative dominance
= Total basal area of a species/total basal area of all species \times 100

Importance Value Index (IVI) = \(\text{Sum of relative density + relative frequency + relative dominance}\)

Species diversity of each forest type was determined using Shannon-Weiner Index (H’) = \(\sum (\text{ni}/N) \ln (\text{ni}/N)\) (Shannon and Wiener, 1949; Odum, 1971). Where,
\(\text{ni} = \text{IVI of individual species}\)
\(N – \text{IVI of all species}\)

Concentration of dominance was also measured using the formula (Simpson, 1949); \(C= -\sum(\text{ni}/N)\), where, \(\text{ni}\) 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 nigroliata.
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.

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

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 0.494 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

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

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

<table>
<thead>
<tr>
<th>S. No</th>
<th>GBH Class</th>
<th>Species</th>
<th>Individuals</th>
<th>Percent to the total</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>&lt;30</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>2</td>
<td>30-60</td>
<td>3</td>
<td>94</td>
<td>94.00</td>
</tr>
<tr>
<td>3</td>
<td>60-90</td>
<td>2</td>
<td>2</td>
<td>2.00</td>
</tr>
<tr>
<td>4</td>
<td>90-120</td>
<td>1</td>
<td>1</td>
<td>1.00</td>
</tr>
<tr>
<td>5</td>
<td>120-150</td>
<td>1</td>
<td>1</td>
<td>1.00</td>
</tr>
<tr>
<td>6</td>
<td>150-180</td>
<td>2</td>
<td>2</td>
<td>2.00</td>
</tr>
<tr>
<td>7</td>
<td>180-210</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>8</td>
<td>210-240</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>9</td>
<td>240-270</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>10</td>
<td>270-300</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>11</td>
<td>&gt;300</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
</tbody>
</table>

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

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

<table>
<thead>
<tr>
<th>Wet Bamboo Brakes (2E2)</th>
<th>Family</th>
<th>Species</th>
<th>Total individuals</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Lannea coramandelica</td>
<td>Anacardeaceae</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>Salmalia insignis</td>
<td>Bombacaceae</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>Dipterocarpus griffithii</td>
<td>Dipterocarpaceae</td>
<td>1</td>
</tr>
</tbody>
</table>
Aglaia andamanica  Meliaceae  2
Dysoxylum arborescens  1
Champeria manillana  Opiliaceae  1
Pterospermum aceroides  Sterculiaceae  2
Oxytenanthera nigrociilata  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 nigrociilata (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, Anacardeae 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.

References


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

R.K. Verma

Forest Pathology Discipline, Forest Protection 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, India
E-mail: rkverma28@rediffmail.com; vermaramk@icfre.org

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., 1957a, b; 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
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

<table>
<thead>
<tr>
<th>SN</th>
<th>Name of fungus</th>
<th>Habit</th>
<th>Distribution</th>
<th>Reference</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td><em>Humaria aurantia</em> (Clem.) Häffner, Benkert &amp; Krisai = <em>Scutellinia aurantia</em> (Clem.) Waraitch</td>
<td>On rotten pieces of coniferous wood and much humicolous soil, under <em>Cedrus deodara</em> forest</td>
<td>Patni Top, Udhampur, Jammu and Kashmir</td>
<td>Waraitch (1977)</td>
</tr>
<tr>
<td>4.</td>
<td><em>Humaria cubensis</em> (Berk. &amp; M.A. Curtis) K.S. Thind &amp; J.S. Sethi ≡ <em>Peziza cubensis</em> Berk. &amp; M.A. Curtis</td>
<td>on rotten wood, on soil under <em>Cedrus deodara</em> forest</td>
<td>Mussoorie, Uttarakhand</td>
<td>Third and Sethi (1957a)</td>
</tr>
<tr>
<td>5.</td>
<td><em>Humaria gerardii</em> var. <em>gigantea</em> K.S. Thind &amp; Pr. Singh</td>
<td>on humicolous soil under oak forest</td>
<td>Mussoorie, Uttarakhand</td>
<td>Third and Singh (1959)</td>
</tr>
<tr>
<td>7.</td>
<td><em>Humaria gregaria</em> Rehm</td>
<td>on soil amid mosses under <em>Cedrus</em> forest</td>
<td>-</td>
<td>Third and Sethi (1957a)</td>
</tr>
<tr>
<td></td>
<td><strong>Humaria haemastigma</strong> (Hedw.) Massee ≡ <strong>Lamprospera haemastigma</strong> var. gigantea K.S. Thind &amp; Pr. Singh</td>
<td></td>
<td>Mussoorie, Uttarakhand</td>
<td>Thind and Singh (1959)</td>
</tr>
<tr>
<td>---</td>
<td>---</td>
<td>---</td>
<td>---</td>
<td>---</td>
</tr>
<tr>
<td>9.</td>
<td><strong>Humaria hemisphaerica</strong> (F.H. Wigg.) Fuckel ≡ <strong>Peziza hemisphaerica</strong> F.H. Wigg.</td>
<td>on dead twigs and soil under <em>Cedrus</em> forest and old branch of <em>Madhuca latifolia</em></td>
<td>Mussoorie, Uttarakhand and Mandla, Madhya Pradesh</td>
<td>Thind and Sethi (1957a)</td>
</tr>
<tr>
<td>10.</td>
<td><strong>Humaria irregularis</strong> (Clem.) K.S. Thind &amp; Waraitch ≡ <strong>Scutellinia irregularis</strong> Clem. ≡ <strong>Patella irregularis</strong> (Clem.) Seaver</td>
<td>-</td>
<td>-</td>
<td>Thind and Waraitch (1971)</td>
</tr>
<tr>
<td>11.</td>
<td><strong>Humaria masseeana</strong> Sacc. &amp; D. Sacc.</td>
<td>-</td>
<td>Garhwal, Uttarakhand</td>
<td>Butler and Bisby (1931)</td>
</tr>
<tr>
<td>12.</td>
<td><strong>Humaria mussooriensis</strong> K.S. Thind, E.K. Cash &amp; J.S. Sethi</td>
<td>on the soil under coniferous forest</td>
<td>Mussoorie, Uttarakhand</td>
<td>Thind et al. (1957)</td>
</tr>
<tr>
<td>13.</td>
<td><strong>Humaria orthotricha</strong> (Berk. &amp; M.A. Curtis) Sacc. ≡ <strong>Peziza orthotricha</strong> Berk. &amp; M.A. Curtis</td>
<td>on dead stem of <em>Trewia nudiflora</em></td>
<td>Dhanolti, Mussoorie, Uttarakhand</td>
<td>Thind et al. (1957)</td>
</tr>
<tr>
<td>15.</td>
<td><strong>Humaria pygmaea</strong> (Clem.) K.S. Thind &amp; J.S. Sethi</td>
<td>on soil under <em>Cedrus</em> forest</td>
<td>Uttarakhand</td>
<td>Thind and Sethi (1957b)</td>
</tr>
<tr>
<td>16.</td>
<td><strong>Humaria scutellata</strong> Fuckel</td>
<td>on dead wood and dead twigs and on dead wood of <em>Cedrus deodara</em></td>
<td>Dehra Dun andMussoorie, Uttarakhand</td>
<td>Thind and Sethi (1957a)</td>
</tr>
<tr>
<td>17.</td>
<td><strong>Humaria sp.</strong></td>
<td>on dead foliage of <em>Cupressus</em> sp.</td>
<td>Mussoorie, Uttarakhand</td>
<td>Thind and Singh (1960a)</td>
</tr>
<tr>
<td>18.</td>
<td><strong>Humaria stercorea</strong> Fuckel</td>
<td>on buffalo dung</td>
<td>Mussoorie, Uttarakhand</td>
<td>Thind and Singh (1959)</td>
</tr>
<tr>
<td>19.</td>
<td><strong>Humaria subreticulata</strong> K.S. Thind, E.K. Cash &amp; Pr. Singh</td>
<td>on soil amid mosses</td>
<td>Mussoorie, Uttarakhand</td>
<td>Thind et al. (1959a)</td>
</tr>
</tbody>
</table>
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

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

**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, Denmark (Côte d'Ivoire), Italy, Russia, Bavaria (Germany), Belgium, Hungary, America (Denison, 1959, 1964; Dennis, 1968; Dissing,1981; Elliott and Kaufer, 1974; Korf, 1954; 1960; Pfister, 1979; Ramamurthi et al., 1957; Seaver, 1928; Seaver, 1942; Weber et 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.

**References**


Role of kairomones in integrated pest management

Department of Entomology
Institute of Forest Biodiversity (ICFRE, Dehradun)
(Indian Council of Forestry Research & Education, Ministry of Environment, Forests and Climate Change, Govt. of India)
Dulapally, Hyderabad- 500 100, Telangana, India
Email: deepam@icfre.org

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 modify insect 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 host selection 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 Hepburn demonstrated 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 of the 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 of insecticide 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 tsetse 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 tetracopaene. Parakairomones may have more favorable physical and chemical properties than natural kairomones. Thus, the parakairomone cue-lure or (4-p-acetoxyphenyl)-2-butane is about 17-fold more volatile than the kairomone raspberry ketone of (4-hydroxyphenyl)-2-butane and is a more effective lure for the melon fly, although raspberry ketone is more persistent. Similarly, the Japanese beetle lure, phenethyl propanoate, is a parakairomone of the natural kairomone phenethanol, and 4-methoxyxynononitrile is a paraffkairomone of the lure for the western corn rootworm, 4-methoxyxynononaldehyde. Parakairomones may have more favorable toxicological properties than kairomones; for example, the parakairomone of the oriental fruit fly, 3,4-dimethoxy-1-propybenzene, as compared with the kairomone methyl eugenol or 3,4-dimethoxy-1-allylbenzene. 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 pest populations 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 the chemical 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 (Diabroticites and 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.

References


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

Pawan Kumar¹ and Akhil Kumar²

¹Forest Protection Division,
Tropical Forest Research Institute
(In Indian Council of Forestry Research & Education, Ministry of Environment, Forests and Climate Change, Govt. of India)
P.O. RFRC, Jabalpur- 482021 (M. P.)
²Himalayan Forest Research Institute
(In Indian Council of Forestry Research & Education, Ministry of Environment, Forests and Climate Change, Govt. of India)
Shimla (H.P.)-171009
pawan_hfr@rediffmail.com

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 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 pressures. 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. euramerica*na (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: Noctuidae). 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, leaves 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 adapted 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 wildlife 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, leaves, 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.

Acknowledgements: Authors are highly thankful to DFO Wildlife Kaza (Spiti), Himachal Pradesh for providing financial assistance to carry out this survey work. Thanks are also due to Director, HFRI, Shimla for providing necessary facilities to accomplish the work in stipulated time frame.
परिचय (Introduction)

कीटों द्वारा की जाने वाली परामर्श (Pollination) क्रिया अधिकतर पौधों और हेतुओं के जीवन का आधार है। कीट न केवल परामर्श के स्थायित्व के लिए अन्य प्रजातियों के साथ संलग्न (Balance) करते हैं अन्य ईस्तेमाल में भी इनकी भाषा अर्थ-विश्लेषण महत्त्वपूर्ण है। परामर्श को सुरक्षा प्रदान करते हैं लाभकारी कीटों का स्वाभाविक अर्थ है। ये कीट विभिन्न प्रजातियों से मात्र एवं अन्य जीव प्रजातियों के लिए उपयोगी है। इन कीटों के बिना स्वाभाविक तरीके की स्वाभाविक कुल्पना मात्र ही होता है। प्राथमिक युग से ही अवुमोलोजिस्ट में रहते वाले विषय में सर्वथा महत्त्वपूर्ण प्रजातियों में शुरुआत कीर्ति की लघुभाग 640,000 जातियों में से 10,000 जातियों ही सत्र घट पड़ाती है। कीटों का अध्ययन कीट विज्ञान (Entomology) कहलाता है।

आर्थिक कीट विज्ञान (Economic Entomology) के अन्तर्गत लाभदायक और भाषा कीटों के महत्व (importance/values), नियंत्रण (control mreasures), विस्तार (Extension) और अर्थव्यवस्था (Appreciation) को सम्मिलित किया जाता है।

सन 1735 में महान वैज्ञानिक लीनियस ने इनका वर्णन किया।

अप्राप्तविश्लेषियों (Invertebrates) के इस संघियापाद (Hexapoda) कीटों का शरीर सिर, बंदा और उद्ध में भिन्न उद्ध में विभाजित होता है। तीन जोड़े पैर तथा नीचे बील एंटिटा होती हैं। संयुक्त तेज़ पर्युष पर्युष तेज़ चार समय जरूर नेत्र भी पाये जाते हैं। परिवर्धन (Development) (डिव- पूपा- वयस्क) साधारणतः: रूपांतरण (Metamorphosis) द्वारा होता है। रूपांतरण वृद्धि डिम / निफ से (Growth), भेदीकरण पूपा से तथा प्रजनन (Reproduccion) वयस्क से प्रशिक्षित होता है। एक्शेपोडा के घनपाद वर्ग इस्तेमाल (कटे हुए) के लिए उपयोगी है। इन कीटों के बिना स्वाभाविक तरीके की स्वाभाविक कुल्पना मात्र ही होता है।
कुछ कीट वापस, जल्ल कीट हैं जो अथवा तरंगे के माध्यम से अपने पथ से भटककर अन्य स्थानों पर पहुंच जाते हैं जो उनके लिये भविष्यवाणी का कारण बनता है तथा कभी कभी इसे नष्ट कर देता है। साथ ही इन कीट पर आधित रहने वाले मधुकी कीटों के लिये यह नापकोटी लिखा होता है।

सत्कार सहायता (Active companionship):
कीटों (जैसे लेटी बर्ड बीटल) में विशेष परिस्थितियों (भोजन, निद्रा, मैथुन, समयानुसार प्रतिकूल परिस्थितियों वीमककालीन (Estivation) एवं शीतकालीन (Hibernation) स्थानांतरण, उदाहरण के दर्शन ही दल के रूप में होना पाया जाता है।

रक्षक समुह (Protective aggregation):
कुछ कीट जैसे यूं संग्रह, तिलमी, मौख, मरक्क, मनच्य, तिलमेया, मधुमक्क, चीटी अपनी रा हेतु भविष् य के लिये जैसे नए दल बनाकर गमन करने वाली (Migrating aggregation) जबकि सामान्यता मैथुन के उद्देश्य से दलों में भ्रमण करने और उन्हें वाले (Swarming aggregation) कीट मधुमक्क, चीटी तथा दीमक प्रजाति होते हैं।

शाँत समूह, पृथ्वीराज एवं एकांकन कीट: कुछ कीट जैसे चीर पाद तिलमियाँ समूह बना कर सोती हैं (Sleeping aggregation) तो कुछ कीट भोजन के अभाव में झुंझुं कर होकर (पृथ्वीराज) दूसरे स्थान को चलते हैं। कभी, मधुमक्क तथा बर की कुछ प्रजातियाँ एकांकन (Solitary insects) होती हैं।

मृत्युमक्क, प्रधान कीट एवं बाहक: भासोन्युरा, कॉलियोरेक्ट्रा आदि के कीट में हुए तथा दूसरे अस्तिक विभिन्तित पदार्थों से भोजन पाने करते हैं (Saprophagous insects) इसी प्रकार ओकोनेट, प्लिकोरेट्रा, हाइमोरेट्रा के कीट प्रधान कीट (Predatory insects) होते हैं। कॉलियोरेट्रा, लेपिडोरेट्रा, हमोरेट्रा, भाइसोनोरेट्रा, किटे तथा लिपिडोरेट्रा के कीट रोग एवं अन्य कारकों के बाहक (Carrier) होते हैं।

कीटों से लाभ (Benefits of Insects)
कीट वन, भीतीगर एवं रोगियों में नाविककीटों को खाना (उदाहरण के लिये लैबिसिया द्वारा एफिड एवं अन्य पतंगों को खाना जाता) अथवा अन्य प्रकार से परिचितिक तंत्र को सुधार एवं स्वास्थ्य प्रदान करते हैं जैसे किलर बना, टेक्टनिकलिम, ड्राइफोग्रामा, सील्जर बीटल, इन्सुक्सन वास्त, व्लास्टोमाइटा कीट इत्यादि।

क्षण के से कीट पराराज द्वारा गुणात्मक वुड्स (मधुमक्क, तिलमिया) करते हैं, लाभदायक उत्पाद (जैसे एरिसमस कीट द्वारा साधित चाना मोम, लेसिफर या टेक्निलिम द्वारा लाभ, मधुमक्क शहद, वीमिक्स मोराइस द्वारा समाप्त तथा अन्य उपयोगी वस्तुएं (टेनिन, रंजक, टर्की रेड) एवं औषधियाँ हेतु बनाते हैं। कुछ कीट जैसे वूं, हिमी, शीगुर, तिलमेया, चीटी, दीमक, तिलमेया, ड्रिग्नोमोरेट्रा, कुछ प्रजातियों के बील औषधियाँ की कमी को पूरा करने हेतु जीव जंतुओं (श्रिक्षक, सर्प, मेंडक, पक्षीय तथा मनुष्य/जंतुतिलियाँ) एवं पीठियाँ (लेपीमीज,डोरेसिया, स्वाइलिडयम) द्वारा भोज्य पदार्थों के रूप में उपयोग में लाया जाते हैं।

प्रधान कीट द्वारा हानिकारक बुखारों तथा महलों की संख्या को मिलकर करने में उपयोगी सिद्ध होकर सकते हैं। पर्यावरणीय परिवर्तन का सूक्ष्म एवं सुंदरता की प्रशिक्षित तिलमियाँ एक सूक्ष्म से सूक्ष्म फूल जाती हैं जिससे पाठ सुरागित होते हैं, नयी – नयी पौधा जातियों का विकास होता है। कुछ पौधा पराराज हेतु इन तिलमियों पर सीमित होते हैं। तिलमियों से बना ये सील्जर राम्य न केरल सुखद अनुभूति देता है, बल्कि हम भी प्रसिद्ध करता है, इस प्रकार स्वास्थ्य के लिए भी लाभ कर होता है। पर्यावरण संरक्षण में इसका योगदान महत्वपूर्ण है। क्योंकि तिलमियाँ कीटनाशकों के लिए अति स्वदेशी हैं। कुछ अंक, रूप में घोरों दत्तक करना बाहर लाल चीटियाँ मिट्टी में बाहर प्रवाह को संतुलित करती हैं। पर्यावरण को स्वस्थ एवं स्वस्थ बनाती है। हानिकारक कीटों को
Sonification, References - 1925, 1940 (1942)

Apis dorsata Fabricius, 1793
Order: Hymenoptera
Family: Apidae

Kerria lacca Kerr, 1782
Order: Hemiptera
Family: Kerriidae

Canthecona furcellata Wolff, 1811
Order: Hemiptera
Family: Pentatomidae

Crocothemis servilia Drury, 1773
Order: Odonata
Family: Libellulidae

1: मधुमक्खी 'एपिस प्रजाति' के छट्टे
2: लाख कीट 'कर्रिया लैका'
3: भक्षी बग 'कैथिकोना फसिलिटा'

4: ड्रैगन फ्लाइ 'क्रोकोचेमिस सर्विलिया'
कथा उत्पादक खेर
ममता पुरोहित, पूर्णिमा श्रीवास्तव एवं राजेश कुमार मिश्रा
उपन्यासिक ब्रह्मीय बन अनुसंधान संस्थान
(भारतीय वाणिज्य अनुसंधान एवं शिक्षा परिषद्, पश्चिम बंगाल, बन और जलवायु परिवर्तन मंत्रालय, भारत सरकार)
पो.आर.एफ.आर.सी., मंडला रोड, जबलपुर (म. प. -) 482 021

खेर का वृष्टि
खेर लेयूमिनोसी कुल के उपकुल माइमोसीसी का सदस्य है। इसका वातावरणिक नाम अकेशिया खेत्रु है। इसके वृष्टि मध्यम ऊँचाई (08 से 10 फुट) के होते हैं जो पूरे भारत वर्ष में जैसे मध्य प्रदेश, उत्तर प्रदेश, पंजाब, बिहार, उड़ीसा, आसाम, बंगाल, गढ़वाल, कुर्मांट आदि प्रदेशों में अत्यधिक आत्मा और अत्यधिक शुष्क स्थानों को छोड़ कर 1200 से 1300 मीटर की ऊँचाई तक पाये जाते हैं। इसी छाल गहरे रंग की होती है।
तरूण शाखाएं गहरे कलर्ड रंग की होती हैं जिन पर कलर्ड या काले रंग के चमकदार स्टीपसुलर काटे पांजे जाते हैं। पतलियां बाईकलेट तथा पतरक बादलों, रेखायां और पृथ्वीय तृण रहित होते हैं। वृन्त रहित पीले या कीम रंग के पुष्प कलर्ड स्थायिक पुष्प क्रम में लगे रहते हैं। इसी तीन प्रजातियाँ अकेशिया खेत्रु, अ. केशुआईडिया तथा अ. सूनदा पायी जाती हैं। यह देखा गया है कि नदी - नालों के किनारों बिन के आसपास की भूमि पर खेर सामूहिक रूप से पाया जाता है।

जलवायु
खेर न्यूस्टम तापमान 2.5 से 7.5 और अधिकतम तापमान 40 डिग्री से. से 50 डिग्री से. तथा 50 से 220 से.मी. वार्षिक बाले स्थानों पर वृद्धि कर सकता है। अधिक वर्षा व रेतीले भागों में भी इसकी वृद्धि देखी गयी है।

मूदा
खेर प्रायः सभी प्रकाश की मूदा में जहाँ पानी का निकासी अवशेष डाला है वृद्धि कर सकता है। परन्तु अधिकतर यह दोमट मूदा, रेतीली मूदा, बजरी युक्त जलध कृत मूदा में पाया जाता है। बंजर व पथरीली मूदा में भी वृद्धि कर सकता है।

वृद्धि के लिए द्वारा
खेर के पीतों की वृद्धि हेतु-
1. खेर का प्रकाश आवश्यक है, यह प्रकाश खेर के पीतों में पाया जाता है।
2. सुर्खीय या जलध के गहरे संसाधन में पाया जाता है।
3. पीते के दंड देवता में पाया जाता है।

फल
खेर की फलियाँ वरिष्ठ होने पर गहरे कलर्ड रंग की हो जाती है। फलियों में 03 से 10 तक
बीज पाये जाते हैं। एक किलो ग्राम में 4500 से

प्रति तक फलियाँ आती हैं तथा 10 ग्राम में
लगभग 40 से 45 बीज आते हैं।
बीज: बीज कल्चर रंग के तथा चपटे होते हैं। बीज में 60 से 80 प्रतिशत तक अंकुरण
पाया जाता है।
बीज प्राप्त करना
जब फलियाँ पूर्ण रूप से विकसित होकर परिपक्व
हो गई हों परन्तु सूखी न हो तभी उन्हें बूटों की
शाखाओं से एकत्र कर लेते हैं और धूप में सुखाएं।
अर्थात् तब सूख जाने पर फलियाँ की लकड़ी
के डंट से अर्थात् तरह पीटकर बीज अलग करते हैं
और बिजली अलग कर उन बीजों को साफ चुराए
करते हैं। पौधे तैयार करने के लिए ताजे बीजों का
उपयोग किया जाता है। क्योंकि भंडारण के
दौरान कीड़े लग जाते हैं जिससे अंकुरण क्षति
प्रभावित हो जाती है एवं अधिक समय तक
भंडारण बीजों की अंकुरण क्षति समाप्त हो
जाती है। बीज के बूटों में डूबी वर्ष प्रगति मात्र में
फल उत्पन्न होता है। इसलिए ताजे बीज
आसानी से उपलब्ध हो जाते हैं।
बीज उपचार
अंकुरण हेतु बीजों के उपचार की कोई
आवश्यकता नहीं होती हैं फिर भी यदि बीजों की
बुझाई पूर्व 24 घंटे के लिए साधारण पानी में
भिन्नकर रख दिया जाए तो एक साथ अधिक से
अधिक बीज अंकुरित होते हैं।
रोपण हेतु पौधे तैयार करना
बीज के बीजों को सीधे रोपण स्थल में बोया जा
सकता है या रोपणी में पौधे तैयार कर रोपण
स्थल में पौधों को रोपा जाता है।
बृक्षारोपण स्थल में सीधे बुझाए
बीज के बीजों को बृक्षारोपण स्थल में अप्रैल व मई
माह में 30 से. मी. चौथी व 30 से.मी. महीने
खाइयाँ 04-04 मी0 के फासले पर खोदी जाती
है। तेज धूप से खाइयाँ व मिट्टी का उपचार हो
जाता है जिससे हाथिकाक चीदाणु मर जाते हैं
मिट्टी मुरमपी जाती है। जुलाई मह के अंत में
खाइयाँ को मिट्टी से पूरा भरकर उन पर 15
से.मी. ऊंची मिट्टी चढ़ाकर में बनाई जाती है
तथा 04-04 मी. की दूरी पर बीज बोकर
आवश्यकतानुसार सिंचाई करते हैं। प्राय: 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 मात्र में मिलाकर मूर्त मिश्रण तैयार
किया जाता है। पोलीथिन की शैलियों को मूर्त
मिश्रण से भरकर प्रत्येक खादी में 02-02 बीज
बोये जाते हैं। बीजों की बुझाई पूर्व 24 घंटे
साधारण पानी में बुझाकर उपचारित करते हैं।
पोलीथिन की शैलियों की आवश्यकतानुसार
सिंचाई करते हैं। प्राय: 07 से 10 दिन के अंदर
अंकुरण पूरा हो जाता है। जब पौधे 05 से 10
से.मी. तक लगे हों तब तक प्रत्येक खादी में
01 पौधे छोड़कर अतिरिक्त पौधे निकाल दे हैं।
वर्ष फर्ज आने तक पौधे 30 से 40 से. मी. तक
लगे हो जाते हैं। अब इन पौधों को बृक्षारोपण
स्थल पर अप्रैल व मई माह में तैयार किये गये 45
x 45 x 45 से. मी. माप के गढ़ों में लगाया जाता है। गढ़ों की घट्टी में गोबर की पकी खाद तथा बिलासकर गढ़ों का घट्टी से अच्छी तरह भर दिया जाता है और आवश्यकतानुसार चिंचाई कर दी जाती है। पीधे लगाने समय पोलीथीन की भैंसियां को साधारण पूर्वक अलग करना चाहिए। जिससे जड़ों को नुकसान न पहुँचे।

पीध वृद्धि
पीधे सामान्य गति से वृद्धि करते हैं।

आवश्यक सामग्रीयाँ
1. प्रारंभ से ही पीधों को प्रेषण मात्रा में प्रकाश मिले।
2. पीधों के स्थापित होने तक 2-3 वर्ष तक समय-समय पर निदारूण-गुड़ाई की जाये। ताकि खरपतवार से पीधों को नुकसान न पहुँचे।
3. चूहे, मेहम, सुअर आदि पशुओं से रक्षा के लिए जाए।
4. आग से पीधों को बचाया जाए।
5. मृदा मिथान बली प्रकाश तैयार किया जाए।
6. मिट्टी की बनाई गई मेड़े दो वर्ष तक खुरलखी बनी रहें।
7. प्रारंभिक वर्षों में पीधों को पाला व सूखा से काफी नुकसान पहुँचता है।

बैर की लकड़ी से प्राप्त कल्याण
1. बैर की लकड़ी का सबसे अधिक उपयोग कल्याण बनाने में किया जाता है। यह लकड़ी का उपयोग करके बार-बार उबालकर प्रामाण्य प्राप्त किया जाता है। तथा पानी व जौली निर्माण में काम आता है।

उपयोग
बैर के निम्नलिखित उपयोग हैं।

बैर की लकड़ी से प्राप्त कल्याण
2. लकड़ी से हल व बैलधार के पहिये बनाये जाते हैं।
3. लकड़ी, ओजारां और ओजारां के दस्ते बनाने में काम आती है।
4. लकड़ी, धान कृषित का मूल्य तथा तेल व ग्रहण का रूप निकालने हेतु।
5. लकड़ी का उपयोग नाच की बील बनाने में किया जाता है।
6. लकड़ी का उपयोग ईद-उल-फ़िटर के रूप में किया जाता है। तथा इससे उत्तम प्रकाश का कोयला प्रामाण्य होता है।
7. पत्थरों चारे के रूप में उपयोगी है।
8. उत्तम सुगंध की पीली-सुनहरी गोंद का व्यापारिक महत्त्व है।
9. झाल चमड़ा रंगने के काम आता है।