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# MELISSOPALYNOLOGICAL ANALYSIS FOR STUDY THE IMPORTANCE OF BEE AS POLLINATOR IN DEEPOR BEEL AREA, KAMRUP, ASSAM, INDIA

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**Abstract**

Melissopalynogical study is the applied branch of palynology. During the period of Dec'18 to Nov'19, a melissopalynological analysis was done on 16 no. of honey samples collected from Deepor beel area. After analysis 46 plant species were identified belonging to 32 families. Considering the habit and habitat groups, 24 species were herbs, 5 were shrubs and 17 species were trees again 37 species were terrestrial and 9 species were aquatic.

Melissopalynological analysis can be used to assess the importance of bees in pollination.

***Key words: Melissopalynology, hoey, palynology, Deepor beel, Assam.***

## INTRODUCTION

Pollination is the transfer of pollen, which contains male gamete, from the anther where it is produced to the stigma of gynoecium, the female part of the same or another plant of the same species. This proces results in the fertilization of the plants and ultimately produce seeds. Thus pollination serve as the backbone of complex ecological system ( Heithus 1974).In cross pollination external agents or pollinators play a crucial role. The relationship between flowering plants and their pollinators leads to evolve a interdependence system, which is a significant step in organic evolution (Martin EC, 1992).

Bees are the primary pollinator of the world, play a crucial role for wild and cultivated plants (Winfree R, 2010). They not only produce honey and bees wax but they are also important players of pollination, by this they help us to increases crop yield through cross pollination, improves quality of the seed and fruit and heterosis can be harnessed (Moniruzzamann M, Rahmann MS, 2009). Melissopalynology is the applied branch of palynology deals with the study of pollen grains of honey that bees collect intentionally and accidentally. Melissopalynology has been extensively used to determine the purity, geographical and floral origin of honey (Water R, 1915; Song XY, Yao Y-F, Yang W-D, 2012). Determination of floral origin of honey samples means identify the plant species, where they helped in pollination.

## STUDY AREA

Deepor beel is located within the coordination of 91°35′ to 91°43′ E. and 26°05' to 26°11′ N. and lies on 165 -186 feet above MSL (Saikia and Bhattacharjee, 1987). It is situated on

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the Southern bank of the river Brahmaputra and Village Maj Jalukbari, Pachim Jalukbari, Dharapur and National Highway No.37 lie on the North; Dakhin Jalukbari, Tetelia and Pachim Baragoan to the East; Gorbhanga Reserve Forest, Chakardew Hill and Chilla Hill to the South West and the Village Azara and Kahikuchi to the west. The beel considered being of riverine origin, lies on the Southwestern fringe of Guwahati City, covering an area of about 40 km2 .

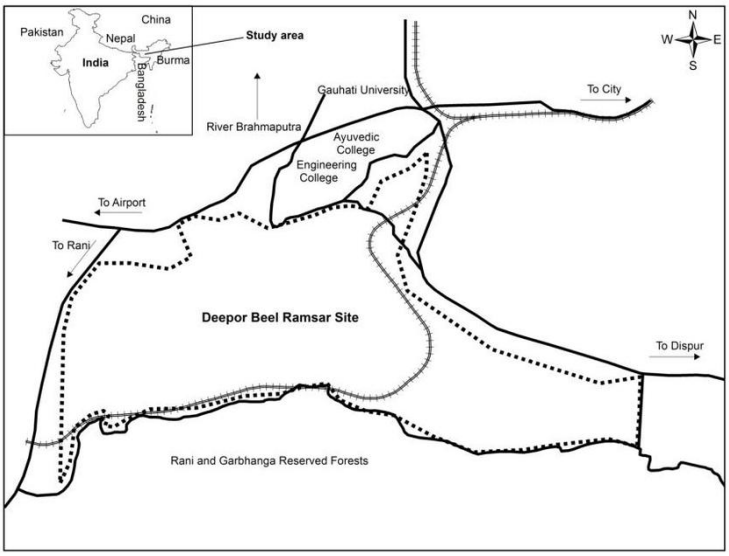


Fig1: Location of Deepor Beel

Deepor beel is one of the richest biodiversity areas within the wetland ecosystem of Assam. Its partially deep water and partially shallow water as well as the presence of high land support large numbers of plant and animal species. Phytoplankton is one of the major components of the lowest level of the producers in the Deepor beel The free floating plants *Eicchornia crassipes*, *Azolla pinnate*, *Pistia stratiotes*, *Lemna minor, Lemna major, Spirodela polkyrrhiza* are exist throughout the year and they become plentiful during the summer. The emergent vegetation includes *Trapa bispinosa, Utricularia flexuosa, Eleocharis pantaginea, Nelumbo nucifera, N. lotus, Nymphaea alba, N. rubra, Sagitaria sagitifolia*etc The other cultivated and non-cultivated plants species available in the beel area are *Alium cepa, Pisum sativum, Brassica juncia, B. rugusa, Beta vulgaris, Momordia charantia, Ducus carrota and Triticum aestivum*. The weeds which are prevalent in the cropped area *are Amaranthus spinosus, A. Viridis, Cyperus rutundus, Cortoria strata, Agaratum conyzoid, Solanum khasianum, Cassia tora, Cassia occidentalis, Solanum torvum, Lucus aspera, Michania scandenses, Cynodon dactylon, Xanthium strumarium, Polygonum hydropiper, P. plebum, P. occidentalis, P. barbahim, Hydrocoliu japonica, Cyperus esculentus, Cyperus flavidus, Elusin indica, Cyperus silletensis, Cyperus flavidus, Elusin indica, Cyperus silletensis.* The dominant tree species found in the high land of Deepor beel are *Tamarind indica, Ficus bengalensis, Ficus religiosa, F. glomarata, Cleofropis gigantia, Dillenea indica, Phoenix sylvistris, Megnifera indica, Albizzia lebbek, Albizia procera, Zigyphus mauricianus, Alstonia scolaris, Casia fistula, Bombax ceba, Bambusa vulgaris, B. aurundinaceae* etc.

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**AIM**

Honey bees collect the nectar from different types of flowers and accidently they collect pollen grains with the nectar. Those pollen grains are preserved in ripen honey and revealed the abundance of particular plant in that area from where the honey samples were originally collected. Identification of those pollen grains will give information about the role of honey bees as pollinator.

The aim of the study was to use melissopalynology to deterime the foraging preference of bees and their role in pollination.

Material and Methods:

During the period Dec'18 to Nov'19, season wise 16 honey samples were collected from the bee hive of *Apis cerana indica*. 4 samples for each season i.e. Winter (Dec-Feb), Premonsoon(Mar-May), Monsoon(Jun-Aug), Postmonsoon(Sept- Nov)were collected to analyze the seasonal variation of pollen grains and their importance in pollination.

10 gm of honey was dissolved in warm distilled water to remove sugars and water soluble components and centrifuged. Carefully the supernatant was discarded not to loss of pollen grains during this process. The residue was then processed for using standard acetolysis method (G. Erdman,1960). After acetolysis method the collected residue which contained pollen grains were mounted in glycerin medium and observed under x450 magnification using light optical microscope (LABOMED). Pollen morphological features of the outer wall formed the basis for the identification of pollen types.

Pollen identification was done on the basis of prepared reference slides made from live materials collected from sampling site and published literature of Erdtman (1954), Nair (1970) and Gupta and Sharma (1986). The absolute numbers of pollen grains was based on the average number of pollen grains in 450 fields of view, the area of a field view, the dispersion of volume and the quantity of honey used (1gm,10gm etc.) (Louveaux *et al*.1970).Determination of Frequency classesand Frequency of Distribution were done by Louveaux(1978) method.The following terms were used for Frequency Classes-"Dominent pollen" (D) occurs in excess of 45%, "Secondary pollen" (S) was in between 16-45% ,"Important minor pollen" (M) falling between 3 and 15%"Minor pollen" (T) was found below 3%.

**Results and Discussion:**

The data obtained after melissopalynological studies have been summarized in Table 1, Table 2, Fig 2 and Fig 3.

Table 1: Identified Angiospermic plants from honey samples in different frequency classes

[Abbreviation used: D=Dominant (>45% of total pollen grains); S=Secondary (16-45% of total pollen grains); M=Important Minor (3-15 %of total pollen grains); T=Minor (<3% of total pollen grains)]

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| Season | Dominant (D) | Secondary(S) | Important Minor(M) | Minor (T) |
|---|---|---|---|---|
| Winter | Nil | *Brassica* sp.<br>*Moringa oleifera* **Lam.**<br>*Neolamarckia cadamba* (Roxb.) Bosser | *Argemone mexicana* **L.,***Bombax ceiba* **L,**<br>*Coriandrum sativum* **L.,***Eichhornia crassipes* **(Mart.),**<br>*Ludwigia adscendens* **(L.) H.Hara**<br>***Polygonum* sp.,***Saccharum spontaneum* **L.** | *Butea monosperma* (Lam.) Taub.<br>*Dalbergia sissoo* **DC.** ,*Eclipta prostrata* **(L.) L.,***Erythrina stricta* **Roxb.,***Hibiscus rosa-sinensis* **L.,**<br>*Impatiens* sp.,*Leonurus sibiricus* **L.**<br>*Macrosolen cochinchinensis* ,**(Lour.) Tiegh.**<br>***Oxalis* sp.,***Balakata baccata* (Roxb.) Esser.** |
| Premonsoon | *Syzygium cumini* **(L.) Skeels** | *Mimosa pudica* L.<br>*Moringa oleifera* **Lam.*Neolamarckia cadamba* (Roxb.) Bosser** | *Acacia auriculiformis* **Benth.,***Azadirachta indica* **A.Juss.,** *Bombax ceiba* **L.,**<br>*Gmelina arborea* Roxb. ,*Helianthus annuus* L.,<br>*Ludwigia adscendens* (L.) H.Hara<br>*Leonurus sibiricus* **L.,*Polygonum* sp.** | *Argemone mexicana* **L.***Butea monosperma* **(Lam.) Taub.,***Dalbergia sissoo* **DC.** ,<br>*Dillenia indica* L.,*Drypetes assamica* (Hook.f.) Pax & K.Hoffm. ,***Impatiens* sp.,**<br>Ipomoea sp.,*Nasturtium officinale* R.Br.<br>*Nelumbo nucifera* Gaertn.,*Saccharum spontaneum* **L.,**<br>***Solanum* sp.,***Tectona grandis* L.f.** |
| Monsoon | Nil | *Lagerstroemia speciosa* (L.) Pers.<br>*Mimosa pudica* L. | *Commelina benghalensis* **L.**<br>*Gmelina arborea* Roxb.<br>*Ludwigia adscendens* (L.) H.Hara<br>*Peltophorum pterocarpum* (DC.) K.Heyne<br>*Tectona grandis* **L.f.** | ***Senna* sp.,***Eclipta prostrata* **(L.) L,** *Hedychium coronarium* J.Koenig,<br>*Hibiscus rosa-sinensis* **L.,** *Nasturtium officinale* R.Br.,*Nelumbo nucifera* Gaertn.<br>*Nymphaea alba* L.,*Nymphaea rubra* Roxb. ex Andrews.,*Nymphoides cordata* (Elliott) Fernald. |
| Postmonsoon | Nil | *Mimosa pudica* L.<br>*Ziziphus jujuba* **Mill.** | *Andrographis paniculata* **(Burm.f.) Nees**<br>*Gmelina arborea* Roxb.<br>*Justicia adhatoda* **L.**<br>*Ludwigia adscendens* (L.) H.Hara<br>*Nasturtium officinale* R.Br.<br>*Neolamarckia cadamba* (Roxb.) Bosser | *Amaranthus spinosus* **L.,***Commelina benghalensis* **L.,**<br>*Eclipta prostrata* **(L.) L.,***Hedychium coronarium* J.Koenig,<br>*Hibiscus rosa-sinensis* **L.**<br>*Impatiens* sp.,*Nymphoides cordata* (Elliott) Fernald,*Panicum khasianum* Munro ex Hook.f.<br>*Peltophorum pterocarpum* (DC.) K.Heyne<br>***Senna* sp.** |

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Table 2: Showing absolute number of pollen grains, distribution of plant species in habit , habitat, no. of identified plant species and no. of families

| Season | Absolute no. of pollen grains | Habit | Habitat | No. of identifies species | **No. of families** |
|---|---|---|---|---|---|
| Winter | 53241 | Herb:11<br>Shrub:1<br>Tree:8 | Terrestrial: 17<br>Aquatic:3 | 20 | 17 |
| Premonsoon | 34190 | Herb:11<br>Shrub:1<br>Tree:12 | Terrestrial: 20<br>Aquatic:4 | 24 | 19 |
| Monsoon | 27843 | Herb:10<br>Shrub:2<br>Tree:4 | Terrestrial: 10<br>Aquatic:6 | 16 | 12 |
| Postmonsoon | 47234 | Herb:11<br>Shrub:2<br>Tree:5 | Terrestrial: 15<br>Aquatic:3 | 18 | 16 |

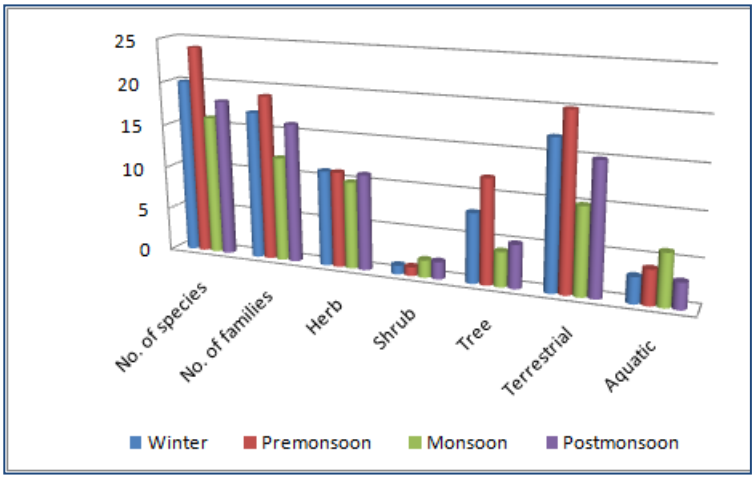


**Fig 2: No. of identified plant species, no. of families, and Distribution of plant species in habit and habitat.**

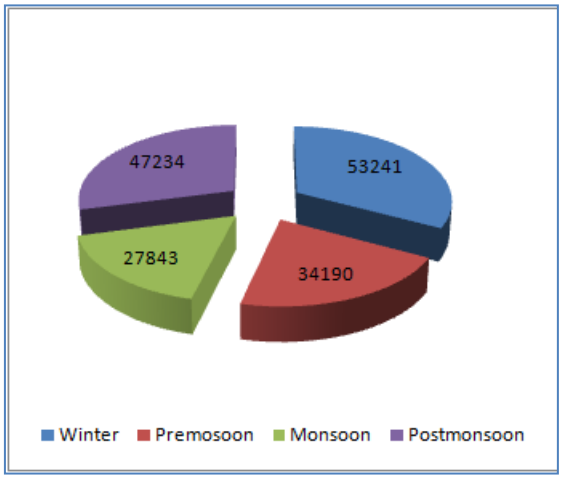


**Fig 3: Absolute number of pollen grains in each season.**

After melissopalynological analysis of 16 no. of honey samples 46 plant species were identified belonging to 32 families.The family Leguminosae was recorded as the highest species representative family with 7 identified plant species which was followed by Lamiaceae with 3 species. Other important families were Brassicaceae, Malvaceae, Asteraceae, Nymphaceae and Poaceae (2 species of each family). Out of 46 species 24 species wererecorded as herbs, 5 shrubs and 17 as trees. Habitat analysis revealed that 37 species were terrestrial and 9 were aquatic.

After seasonal analysis it was observed that samples collected during Winter, Monsoon and Postmonsoon samples were multifloral only Premonsoon samples was unifloral. Dominat (>45% of total pollen count) species of those samples were*Syzygium cumini* (L.) Skeels (Table1).

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Winter honey contained 20 nos. of plant species belonging to 17 families. Out of 17 families Leguminosae was highest species representative family with 3 species and followed by Malvaceae with 2 species. Habit and habitat analysis showed that 11 species were herbs, 1 species was shrub, 8 species were tree again 17 species were terrestrial and 3 species were aquatic (Table2, Fig2).

Identified plant species from premonsoon samples were 24 belonging to 19 families, where Leguminosae(4 species) and Lamiaceae (3 species) were recorded as highest species representative family. Out of 24 species 11 species were herbs, 1 was shrub and 12 species were trees, again 20 species were terrestrial and 4 were aquatic (Table2, Fig2).

Nos. of identified plant species from Monsoon samples were 16 of 12 families. The family Leguminosae with 3 species, Lamiaceae and Nymphaceae with 2 species were recorded as important families.Out of 16 families 10 were herbs, 2 were shrubs and 4 were trees, again 10 were terrestrial and 6 were aquatic (Table2, Fig2).

Postmonsoon samples contained 18 plant species belonging to 16 families of which Acanthaceae and Leguminosae included 2 species of each. Habit and habitat analysis showed that 11 species herbs, 2 were shrubs and 5 were trees again 15 were terrestrial and 3 were aquatic(Table2, Fig2).

All the samples were pure because honey sample with 20,000- 100,000/10gm pollen grains is formed by normal floral source (Jones and Bryant, 1996)(Table2, Fig3).

Honey bees are excellent pollinator because not only collect the nectar from single species but also collect from different varieties of plant species including herbs, shrubs and trees. Their collection is not only restricted for terrestrial plants and aquatic plants also. These collections ultimately help in pollination which is main survival and evolutionary mechanism of plans. Bee communities, both wild and managed have been declining over the last century as pesticide used in agricultural and urban areas increases. We have duty to make such policy which will protect their community,save their correlation that balance environment and vegetation pattern of particular area.

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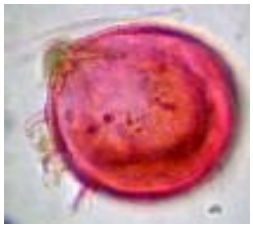
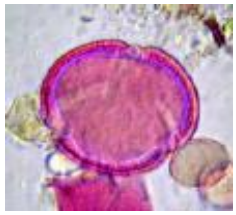
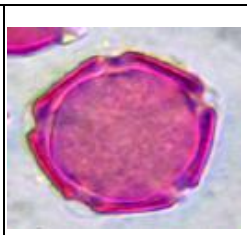
|  *Nymphaea alba* Linn.(450X) |  *Nelumbo nucifera* Gaertn. (450X) |  *Bombax ceiba* Linn. (450X) |  *Impatiens sp.* (450X) |  *Azadiracta indica*A.Juss.(450X) |

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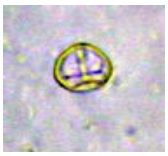
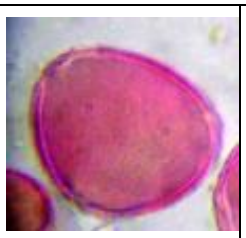
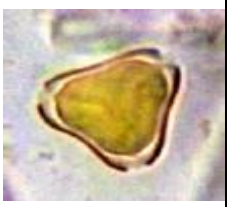
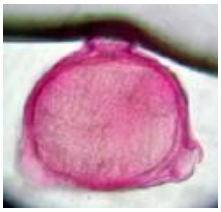
|---|---|---|---|---|
|  *Mimosa pudica* Linn.(450X) |  *Acacia auriculiformis* Benth .(450X) |  *Moringa oleifera* Lam. (450X) |  *Syzygium cumini* Skeels. (450X) |  *Ludwigia adscendens* ( L.) H.Hara(450X) |

Plate1: Microphotograph showing some identified pollen grains.

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