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Diversity of Honeybees Foraging Plants in Nilachal Hill, Kamrup, Assam

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Abstrack

Nilachal Hill is famous for its historical, archeological as well as religious point of view. During the period of January to December 2021, a total of 12 squeezed honey samples were collected for Melissopalynological studies. All collected samples were categorized into Winter, Premonsoon, Monsoon and Postmonsoon according to collection time, where 3 samples were collected from each season. After analysis a total of 43 pollen types belonging to 24 families were found in these samples.The family Leguminosae was recorded as highest species representative family containing 6 pollen types. In terms of frequency of distribution (FD%) *Mimosa pudica* Linn. was 100% distributed pollen type present in all honey samples. The calculation of frequency classes showed that only 3 honey samples collected from monsoon season were unifloral contained *Tectona grandis* L.f. as dominant pollen type.

This type of analysis helps us to identify honey bee foraging plants and also variation of flowering plants of particular area.

Key words: Nilachal, Hoeny, Melissopalynology, Honey bee.

Introduction

Honey is one of the oldest food of mankind. The raw materials are pollen and nectar from flowers of various plants and are the major source of proteins for bees (Dhawan et al., 2018). Honey pollen analysis is done under the branch Melissopalynology, whichis an applied branch of palynology. Melissopalynological studies dealing with microscopic analysis of the pollen contents of seasonal honeys and pollen loads from a locality, when supplemented with critical field studies involving phenology and floral biology, provide reliable information regarding the floral types which serve as major and minor nectarand or pollen sources for the honey bees (Attri, 2010).

Analysis of pollen contents of honey is useful in the determination of the geographical and botanical origin of particular type of honey (Stawiarz et al., b2010). According to Jones & Bryant (2004) pollen found in honey is used to determine the honey's type. The determination of geographical origin is generally based on the entire pollen spectrum being consistent with the flora of a particular region (Louveaux et al.,1978) or the presence of a combination of pollen type of the particular area. Pollen analysis of honey is also of great importance for the quality control and help to ascertain whether honey is adulterated or not (Maurizio, 1951; Molan, 1998; Louveaux et al., 1978; Terrab et al., 2003).

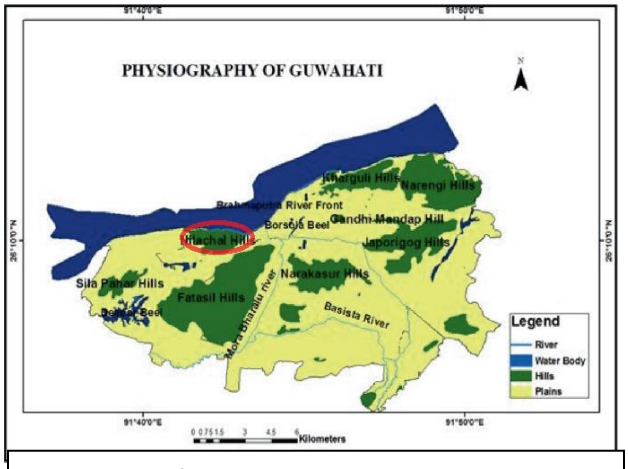


Fig 1: Map of study area

Material and Method:

Study area

The Nilachal Hill is situated at a distance of 7 km from Guwahati is of great historical, archeological as well as religious importance. The Nilachal hills lies between 26º 09' 55.32" N to 26º 09' 91.7" N latitude and 91º 41' 88.7" E and 91º 42' 94.7" E longitudes and the altitude ranging between 50.56 m and 387.18 m above mean sea level.It is a natural heritage of Guwahati city and has a unique ecology with the temple at the top of the hill and covered by dense vegetation. It has also witnessed rapid development during the past years in terms of urbanization and substantially increasing population. The forested vegetation is dominated by trees like *Lagerstroemia parviflora, Lannea coromondelica, Bombax ceiba, Terminalia bellerica, Cassia fistula* etc. In some pockets bamboo and *Schima wallichii* are also found. Among shrubs *Murraya koenegii, Murraya paniculata, Tabernaemontana divaricata* etc are common(Kar *et a.,l* 2012).

Collection of sample:

12 squeezed honey samples of *Apis dorsata* were collected during January to December of 2021 from different localities of Nilachal Hill. All those samples were categorized according to season of the year and seasons were Winter (Dec to Feb), Pre Monsoon (March to May), Monsoon or Summer (Jun to Sep) and Post monsoon (Oct to Nov), 3 samples from each season.Then the collected samples were stored in airtight plastic bottles and labeled. Field surveys were done to document the vegetation growing around the honey collection sites. Floral materials were also collected during the field survey for preparation of pollen reference slides. Those slides were helpful to identification of pollen isolated from honey samples.

Analysis of pollen samples:

For slide preparation I followed acetolysis method of Erdtmann (1960). I also followed the same method to prepare the reference slides from flowering species to identify the pollen grains isolated from honey and bee pollen loads. For pollen analysis of the honey samples, the laboratory methods recommended by Louveaux al el. (1970, 1978) were used. Following his procedure counted 200-300 pollen grains per samples and interpreted in terms of frequency classes. “Dominent pollen” occurs in excess of 45%, “Secondary pollen” in between 16-45%, “Important Minor pollen” falls between 3 and 15% and “Minor pollen” that is found below 3%. Using frequency class system, honey samples were named as uniflora(>45%) and mixed floral type or multifloral. The frequency distribution was also calculated by using Louveaux (1970, 1978) method. The frequency of distribution of a

taxon in a series of honey samples is determined by dividing the number of samples in which taxon occurs by the total number of samples and express in percentage (%) by multiplying 100. Statistical analysis was done by using the software Minitab.

Result and discussion:

During the study period, collected 12 honey samples were categorized into Winter, Premonsoon, Monsoon and Postmonsoon samples and subjected to analyze. A total 43 pollen types belonging to 24 families were identified, some part of the pollens were remained as unidentified. Out of 43 pollen types 4 pollen types belonging to 3 families were identified as Monocotyledons and 39 pollen types belonging to 21 families were as Dicotyledons. Analytical data such as identifying species, families, frequency classes and frequency of distribution (FD%) are presented in Table 1. Season wise numbers of frequency classes are graphically analyzed (Fig:2).Uniflorality was the characteristics of honey samples. The family Leguminosae was recorded as highest species representative family containing 6 pollen types. In terms of frequency of distribution (FD%) *Mimosa pudica* Linn. was 100% distributed pollen type present in all honey samples.The pollen count used to derive the percentage of frequency of the pollen from the samples showed that some species were more frequent in the samples because some plant species readily produce nectar and their flowering period is longer if compared with other species. Some flowering plants may be having good quality of necter. The calculation of frequency classes showed that only 3 honey samples collected from monsoon season were unifloral contained *Tectona grandis* L.f. as dominant pollen type. This analysis

The Dendrogram of the cluster analysis (fig:3) obtained from the data presence or absence of pollen typein particular honey sample. This analysis showed the presence of particular pollen type in different honey samples.

Sample wise analytical data are discussed below:

Winter samples: From winter samples 17 pollen types (plant species) were identified and frequency classes analysed as Secondary pollen(S) 1 (16-45%), Important Minor (M) pollens are 7 (3-15%) and Minor Pollen are 9 (<3%). Dominent pollen type was not recorded and samples were unifloral.

Premonsoon samples: All collected samples during this season were multifloral because absent of Dominent pollen types. Here number of identified pollen types were 25, of which 3 types were recorded as Secondary(S) , 10 as Important Minor(M) and 12 were Minor(T).

Monsoon: Samples were unifloral , all 3 samples contain *Tectona grandis* L.f. as the dominant pollen types. Total 20 pollen types were identified and there was no reported of Secondary pollen types, 8 pollen were Important Minor and 11 were Minor (T).

PostMonsoon:15 pollen types were identified , out of which two pollen types were Secondary pollen, 4 were Important Minor and 9 were Minor pollen grains. All honey samples were multifloral.

Table1: Species name (pollen type), Family, Frequency Classes and Frequency of Distribution

Family and species name	Winter	Premonsoon	Monsoon	Postmonsoon	FD%
Acanthaceae					
1. *Justicia adhatoda* L.				S	25
2. *Andrographis paniculata* Ness.				M	25
3. *Justicia grandarussa* Burm.f.	M	M			25
4. *Phlogocanthus thrysiflormis* (Roxb.) Nees.					25
Amaranthaceae					

1. *Chenopodium album* Linn.	T	T			50
Apocynaceae 1. *Cryptolepsis sinensis* (Lour)Merr.			M		25
Arecaceae 1.*Caryota urens* Linn.			T	T	50
Balsaminaceae 1.*Impatiens balsamina*Linn.	T		T		50
Commelinaceae 1. *Commelina benghalensis* Linn.			T	T	50
Cucurbitaceae 1. *Cucurbita* sp.			M	T	50
Cyperaceae 1.*Pycreus flavidus* (Retz)T.Koyama			T	M	50
Dilleniaceae 1. *Dillenia indica* Linn.		M			25
Lamiaceae 1. *Rotheca serrata* (L) Steane &Mabb. 2. *Gmelina annamensis* Dop. 3. *Ocimum americanum*Linn. 4. *Tectona grandis*L.f.		T M S	T M D	 T T 	50 75 25 50
Leguminosae 1. *Butea monosperma* (Lamk.) Taub. 2. *Caesalpinia pulcherrima (L) So.* 3. *Cassia fistula*Linn. 4. *Dalbergia sisso Roxb.* 5. *Erythrina stricta*Roxb. 6. *Mimosa pudica*Linn.	T T T M	T M T T M	 M M T	 M T	50 50 50 50 50 100
Lythraceae 1. *Lagerostroemia indica* Linn. 2. *Lagerostroemia speciosa*(L) Pers.		T M	T M		50 50
Malvaceae 1. *Bombax ceiba* Linn. 2. *Hibiscus rosa-sinensis*Linn.	M M	T		 M	50 50
Meliaceae 1. *Azadiracta indica* A.Juss. 2. *Melia azedarach*Linn.		S M			25 25
Moringaceae					

1. *Moringa oleifera*Lamk.		M	T		50
Myrtaceae 1. *Callistemon citrinus* (Curt) Skeels. 2. *Psidium guajava*Linn. 3. *Syzygium cumini* Skeels.	 T M	 S	 M M	 T T	 75 75 25
Oxalidaceae 1. *Averrhoa carambola* Linn. 2. *Oxalis* sp.	 M T	 	 T	 	 50 25
Poaceae *1. Panicum khasianum* Munro ex Hook.f. *2. Saccharum spontaneum* L.	 T	 T	 T	 T	 50 50
Polygonaceae 1.*Rumex* sp.		 T			 25
Rhamnaceae 1. *Ziziphus jujube* Mill.				 S	 25
Rubiaceae 1. *Neolamarckia cadamba* (Roxb.)Bosser	 S	 M			 50
Rutaceae 1. *Citrus* sp. 2. *Murraya paniculata* (L.)Jack.	 T	 T T			 25 50
Sapindaceae 1. *Litchi chinensis* Sonn.		 M	 T		 50
Simaroubaceae 1. *Ailanthusintegrifolia* Lamk.	 M	 T			 50

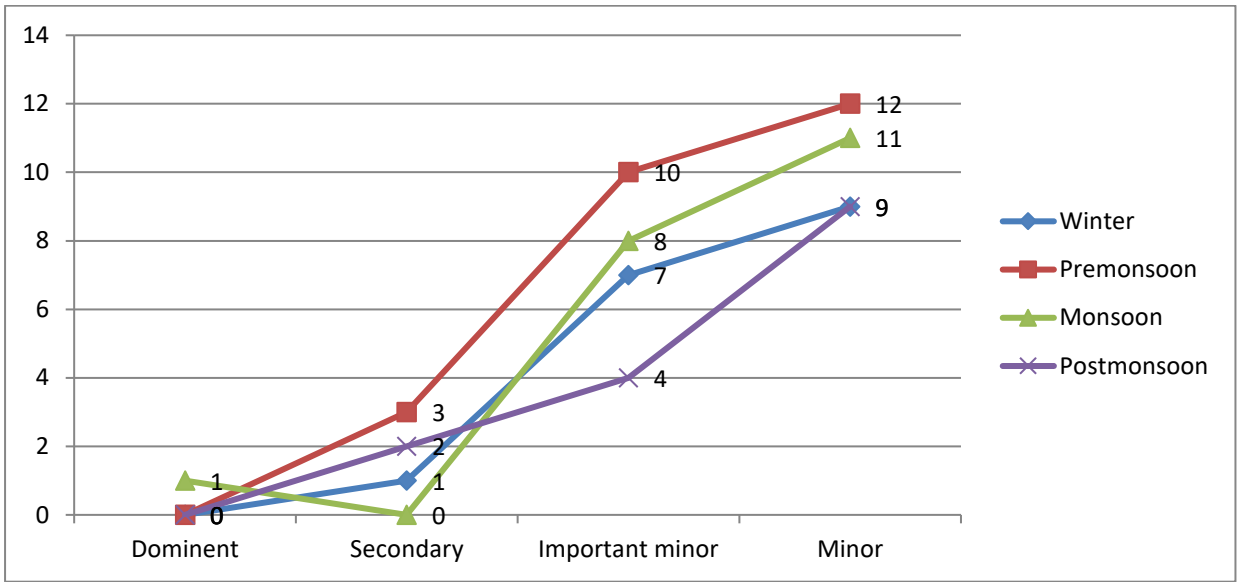


Fig2: Frequency classes of different honey samples.

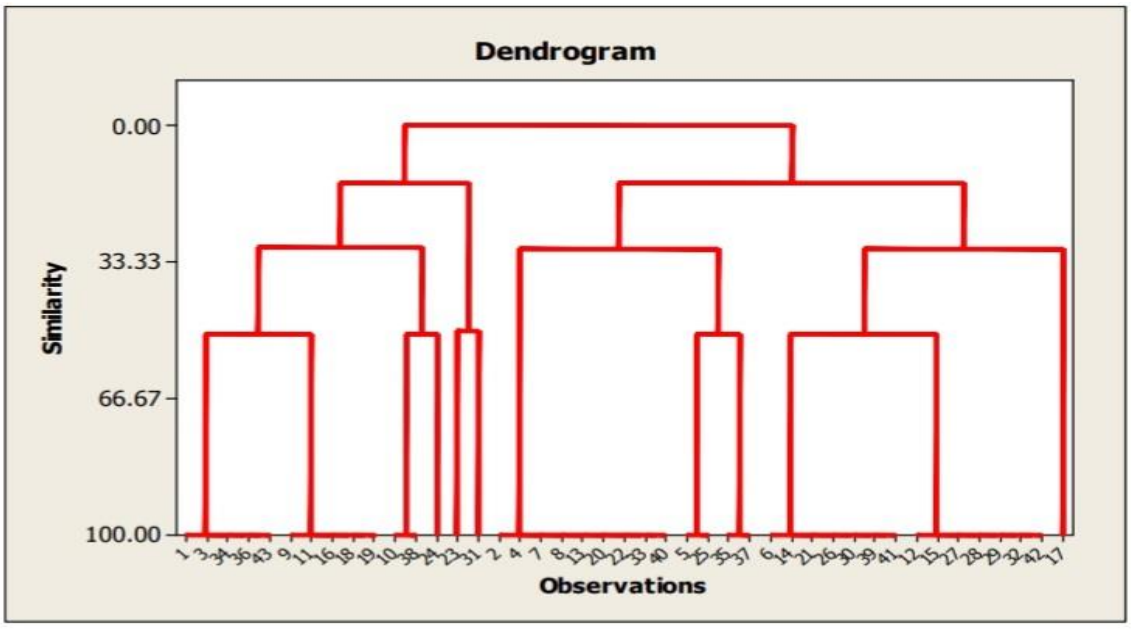
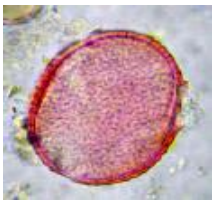
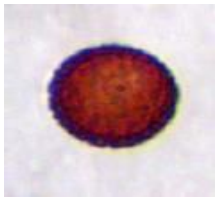
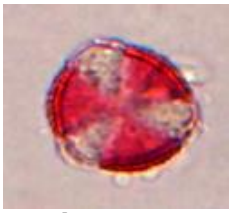
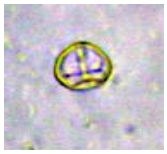
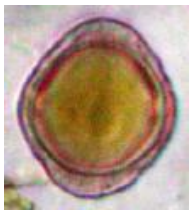
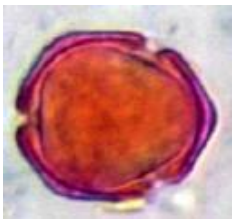
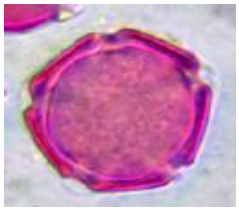
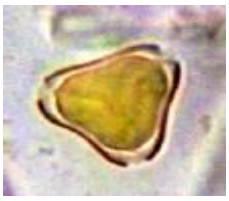
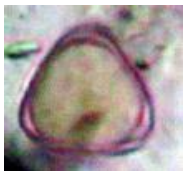


Fig3: Dendrogram obtained in the cluster analysis upon the table of presence of absence of pollen types in particular samples

Plate1: Microphotographs of identified Pollen types

 *Justicia adhatoda* L	 *Phlogocanthus thrysiflormis* (Roxb.) Nees	 *Andrographis paniculata* Ness	 *Chenopodium album* Linn.
 *Impatiens balsamina*Linn	 *Gmelina annamensis* Dop.	 *Tectona grandis*L.f.	 *Butea monosperma* (Lamk.) Taub.
 *Mimosa pudica*Linn.	 *Lagerostroemia speciosa*(L) Pers.	 *Lagerostroemia indica* Linn.	 *Bombax ceiba* Linn.
 *Hibiscus rosa-sinensis*Linn.	 *Azadiracta indica* A.Juss.	 *Syzygium cumini* Skeels.	 *Ziziphus jujube* Mill.

Conclusion: These pollens analytical study provides information of bee resources. The pollen grains extracted from honey samples can be used for the taxonomic identification of honey yielding plants. This type of data help a bee keepers to identify the honey yielding plants and helpful in apiculture. The pollen analysis of different

honey samples shows that honey bees depend on seasonal flowering plants. The high frequency of distribution of their pollen in samples means that they should be considered important and reliable sources of nectar and pollen for honey production.

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