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Research Article

IMPORTANT HONEY BEE PLANTS OF GANAKPARA VILLAGE, UDALGURI, BTAD (ASSAM)

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ABSTRACT
A melissopalynological study was carried out to determine the important bee plants existing in the Ganakpara village of Udalguri district. For this 24 nos. of honey samples were collected for melissopalynological analysis during the period of Jan'14 to Dec'14. After qualitative and quantitative analysis 47 nos. of pollen types were identified up to species level and many more pollen types were remained as unidentified. Out of 24 nos. of honey samples 2 nos. of honey samples were reported as unifloral type and other samples were grouped under multifloral types. Dominant bee plants of this area were *Brassica campestris* Linn, *Bombax ceiba* Linn, *Hibiscus rosa- sinensis* Linn, *Averrhoa carambola* Linn, *Azadiracta indica* A.Juss, *Ziziphus mauritiana* Lamk, *Litchi chinensis* Sonner, *Moringa oleifera* Lamk, *Mimosa pudica* Linn, *Anthocephalus cadamba Miq and Syzygium cumini Skeels*. This type of analysis reveals the floristic composition and potentiality of apiculture of an area.

Keywords: *Melissopalynology, Pollen Type, Honey, Unifloral, Multifloral, Bee Plant*

INTRODUCTION
Honey is a sweet and viscous fluid produced by a bee and derived from raw materials i.e. nectar, sugary secretions and pollen of plants. It is a ready food for direct consumption and can serve as nutritional ingredient and base for numerous finished food products, confectioneries and drugs. Honey is a highly valuable syrup and is better preferred to other sweeteners, because of its nutritional qualities, unique flavour, aroma and high percentage of simple reducing sugars (Ruoff and Bogdanov, 2004; Meda *et al.*, 2005).
Most microorganisms do not grow in honey because of low water cotents (Prescott *et al.*, 1999).
Pollen analysis of honey is of great importance for quality control. Pollen analysis is done under "Melissopalynology" which is one of the applied branch of palynology. Evaluation of plants for their utility as source of bee forage provides the information needed to assess the potential for beekeeping in an area (Moses *et at.*, 1987; Ramanujan *et al.*, 1991). Melissopalynological studies are thus helpful in bee management and in promoting the beekeeping development
Beekeeping industry, one of the important agricultural and forest based rural industries in India, mainly involved in the production of commercial quantities of honey, using essential colonies of the Indian hive bee, *Apis cerana*. Recognition and initial screening of various bee plants representing potential sources of nectar and pollen for the honey bees throughout the year, is an important pre requisite for launching apiary industry in any locality (Kalpana *et al.*, 1997).
The selected place Ganakpara Village is located in between 26.568877N and 91.982117 E. This village is situated in Udalguri District of BTAD, and about 90 km away from Guwahati, the capital of Assam. The main occupation of villagers is cultivation, only a few have engaged as government employee or other occupation. The area is plain and a river Kulshi is flowing between the heart of the village. Dominant plants of this area are different types of grasses, *Bambusa* sp., *Cassia* sp., *Ficus* sp., *Bombax ceiba* Linn, *Brassica campestris* Linn(Seasonal), *Azadiracta indica* A.Juss, *Ziziphus mauritiana* Lamk, *Moringa oleifera* Lamk *Butea monosperma* (Lamk.) Taub, *Anthocephalus cadamba Miq*, *Azeratum conyzoides* Linn, *Adhatoda vasica* Nees, *Polygonum sp., Oryza sativa* Linn(cultivated) etc.
The aim of the present study is to identify the important bee plants of this area, and aware the people about the potentiality of beekeeping industry. Another aim is to study the local vegetation through microscopic analysis of honey samples.

MATERIALS AND METHODS

For analysis during the period of 1st Jan'14 to 31th Dec'14, 24 nos. of honey samples were collected from 6 local bee hives. The name of the samples and their collection date and name of bee hives were given in Table1. All collections were done to cover the whole year.

Table 1: Bee Hives and Samples Name and Date of Collection

Name of Bee Hives	Samples Name	Collection Date	Name of Bee Hives	Samples Name	Collection Date
*BH1	**S1	25/2/14	BH4	S13	19/2/14
	S2	30/6/14		S14	22/6/14
	S3	23/9/14		S15	18/9/14
	S4	25/12/14		S16	28/12/14
BH2	S5	20/2/14	BH5	S17	28/2/14
	S6	27/6/14		S18	20/6/14
	S7	25/9/14		S19	15/9/14
	S8	30/12/14		S20	20/12/14
BH3	S9	29/2/14	BH6	S21	17/2/14
	S10	26/6/14		S22	22/6/14
	S11	27/9/14		S23	16/9/14
	S12	23/12/14		S24	21/12/14

BH; Bee Hive, **S; Sample

For slide preparation we followed acetolysis method of Erdtmann (1960). We also followed the same method to prepare the reference slides from flowering species to identify the pollen grains isolated from honey. For pollen analysis of the honey samples, the laboratory methods recommended by Louveaux *et al.*, (1970, 1978) were used. Following his procedure we counted 200-300 pollen grains per samples and interpreted in terms of frequency classes. "Predominent pollen" (D) occurs in excess of 45%, "secondary pollen"(S) is between 16-45%, "important minor pollen" (M) falls between 3 and 15% and "minor pollen" (T) that is found below 3%. Using frequency class system, honey samples are named as unifloral (more than 45% of total pollen nos.) and multifloral type.

RESULTS AND DISCUSSION

After qualitative and quantitative analysis 47 nos. pollen types belonging to 29 nos. of families were identified up to species level. All these identified pollen types were divided in to four frequency classes on the basis of their nos. present among the total 300 pollen nos. (Table 2). The families were arranged in Table 3 with their nos. of pollen types. All data were also analysed in Figure 1and Figure 2.

This study revealed that *Brassica campestris* Linn was only single pollen types reported as predominant pollen (D) in two samples namely S1 and S9. Those two samples were termed as unifloral samples because they contained a pollen type of more than 45% of total pollen nos. Other 22 samples were recorded as multifloral type. In multifloral samples honey bee doesn't depends on single plant species and prefer to collect nectar from maximum nos. of plants. The uniflorality showed that during the collection period *Brassica campestris* Linn was extensively cultivated in that region.

The secondary pollen types indicated the other important plant species for formation of honey. The analysis showed 7 nos. of pollen types placed under this category. Again, 16 nos. of pollen types were categorised as important minor pollen types and 23 nos. of pollen types were as minor pollen types. Secondary pollen type species were more important bee plant than other two categories. All these species were took the important part of vegetation of that area. The data obtained from families it was showed that two families Caesalpiniaceae and Cucurbitaceae were two families with highest nos. of pollen types (4 types) followed by Malvaceae and Meliaceae 93 types). Three families Pontederiaceae, Arecceae and Poaceae with 4 nos. of pollen types were recorded from monocot.

Table 2: Arranging the Plant Species According to Frequency Classes

Frequency Classes	Species Name
Predominant pollen ("D" >45% Of total pollen nos.)	*Brassica campestris* Linn
Secondary pollen ("S"; 16-45%)	*1.Bombax ceiba* Linn, *2.Averrhoa arambola* Linn *3.Azadiracta indica* A.Juss, *4.Ziziphus mauritiana* Lamk, *5.Litchi chinensis* Sonner, *6.Mimosa pudica* Linn, 7. *Syzygium cumini Skeels* .
Important Minor pollen ("M";3-15%)	*1.Hibiscus rosa- sinensis* Linn ,*2.Hibiscus esculentus* Linn *3.Oxalis corniculata* L, 4. *Citrus aurantifolia* (Chirsten) Swing , *5.Melia azedarach* Linn , *6.Moringa oleifera* Lamk, *7.Cassia fistula* Linn, *8.Psidium guajava* Linn, *9.Lagerostroemia speciosa* (L) Pers, *10.Anthocephalus cadamba Miq* ,*11.Azeratum conyzoides* Linn ,*12.Nymphoides cordata* Low, *13.Sesamum orientale* Linn, *14.Gmelina arbores* Roxb, *15.Drypetes assamica Hook.f, 16.Eichornia crassipes* (Mart) Solms.
Minor pollen ("T";<3%)	*1.Sida rhombifolia* Linn, *2.Toona ciliata* M. Roem ,*3.Cassia sophera* Linn, *4.Cassia tora* Linn, *5.Cassia alata* Linn, *6.Lawsonia inermis* Linn, *7.Cucurbita maxima* Duch , *8.Cucumis sativus* inn, *9.Momordica charantia* Linn, 10. *Luffa cylindrical* Linn, *11.Coriandrum sativum* Linn, *12.Gardenia florida* Linn, *13.Vernonia cinerea* Less, *14.Adhatoda vasica* Nees, *15.Andrographis paniculata* Ness, *16.Ocimum americanum* Linn, *17.Basella rubra* Linn, *18.Polygonum chinensis* Linn,*19.Polygonum hydropiper* Linn, *20.Ricinus communis* Linn,*21.Cocos nucifera* Linn, *22.Oryza sativa* Linn, 23.*Saccharum spontaneum* L.

Table 3: Name of Family and their Nos. of Pollen Types

Name of the Family	Nos. of Pollen Types	Name of Family	Nos. of Pollen Types
1.Brassicaceae	1	16.Apiaceae	1
2.Malvaceae	3	17.Rubiaceae	1
3.Bombacaceae	1	18.Asteraceae	2
4.Oxalidaceae	1	19.Gentianaceae	1
5.Averrhoaceae	1	20.Pedaliaceae	1
6.Rutaceae	1	21.Acanthaceae	2
7.Maliaceae	3	22.Verbenaceae	2
8.Rhamnaceae	1	23.Lamiaceae	1
9.Sapindaceae	1	24.Basselaceae	1
10.Moringaceae	1	25.Polygonaceae	2
11.Mimosaceae	1	26.Euphorbiaceae	2
12.Caesalpiniaceae	4	27.Pontederiaceae	1
13.Myrtaceae	2	28.Arecaceae	1
14.Lythraceae	2	29.Poaceae	2
15.Cucurbitaceae	4		

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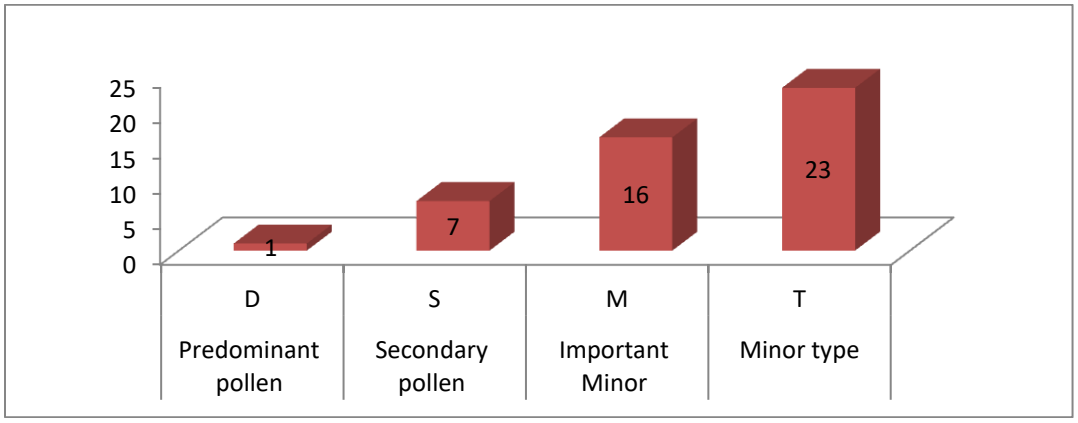

Figure 1: Pollen Types Present in Different Frequency Classes

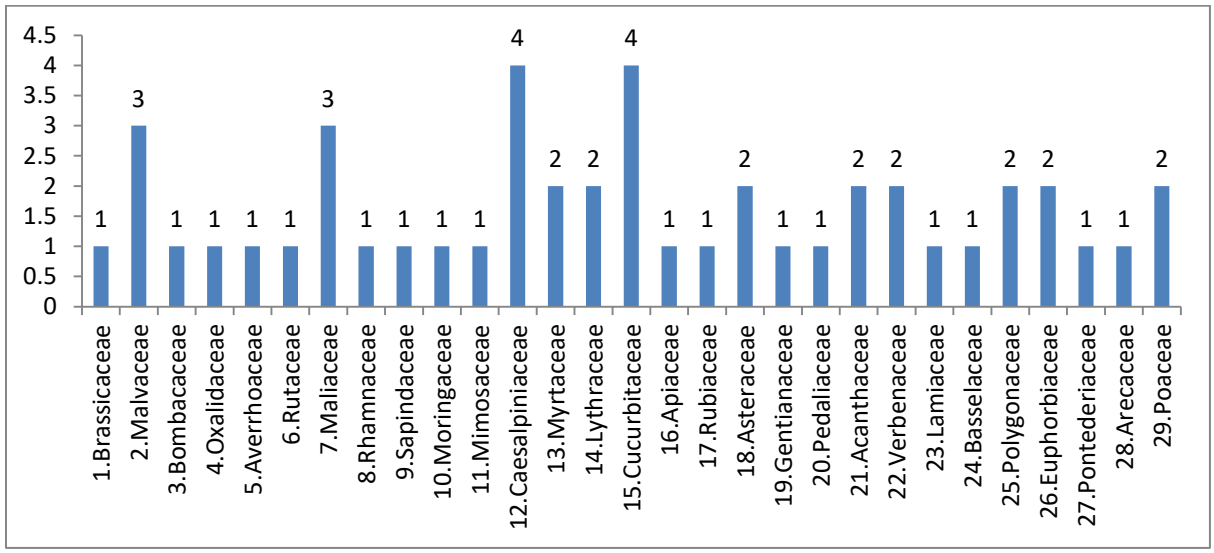

Figure 2: Name of Family and their Nos. of Pollen Types

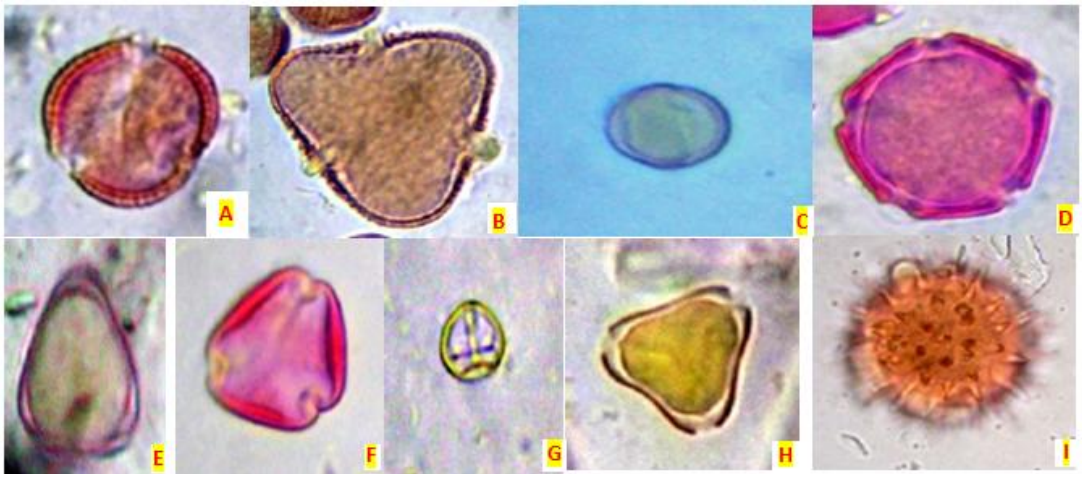

Figure 3: Microphotographs of some Important Identified Pollen Grains: A- *Brassica Campestris* Linn. (650x), B- *Bombax Ceiba* Linn. (400x), C- *Averrhoa Carambola* Linn. (650x), D- *Azadiracta Indica* A.Juss. (650x), E- *Ziziphus Mauritiana* Lamk. (650x), F- *Litchi Chinensis* Sonner. (650x), G- *Mimosa Pudica* Linn (650x), H- *Syzygium Cumini* Skeels. (650x), I- *Hibiscus Rosa-Sinensis* Linn

Conclusion

This analysis focuses the following points:

1. Multiflorality is the characteristic features of maximum honey samples of that area. The multifocal honey sample showed that honey bee collects nectar not only from single plants but also from different plant species.
2. The unifloral honey sample indicate that the availability of particular plant species during particular time. Therefore, two unifloral honey sample points out that *Brassica campestris* Linn was extensively cultivated and made availability to the honey bee.
3. This type of data helps a beekeeper to know the plants important for honey production and important measure to develop the apiculture practice.

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