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# Pollen Characterization of *Apis dorsata* Summer Honey Samples from Nalgonda District of Telangana State, South India

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**ABSTRACT**

*The present paper incorporates qualitative and quantitative melissopalynological analysis of four honey samples of Apis dorsata F. bees from the Nalgonda district of Telangana State during the summer season of 2021. Based on the palynological analysis, all the samples were identified as unifloral, with Borassus flabellifer as the predominant pollen type. Altogether, sixteen palynotaxa, referable to twelve families were identified. These palynotaxa are significant nectariferous plants and are recognized as authentic bee forage plants for the honey bees in the present study area.*

***Keywords:*** *Apis dorsata, Bee forage plants, Unifloral honey, Melissopalynology, Nalgonda,*

## INTRODUCTION

Melissopalynology is the branch of plant sciences that deals with studying pollen found in honey. The palynological analyses of honey and pollen loads are used to know about honey bee foraging ecology, flora visited by the bees and the geographical region of the hive location. Pollen from honey samples provides reliable information about flowers and honey resources and the relative preferences of bees between different synchronous flowering plant species (Deodikar, 1961). Melissopalynology is, therefore, extremely useful for bee hive management and allows the identification of periods of production of unifloral honey, which has high commercial value (Oliveria et al., 2010). The beekeepers do not have information on all the important nectar plants to produce for honey production, and pollen analyses prove to be a useful guide to beekeeping in a region (Song et al., 2012). Melissopalynology works have so far been executed on this aspect through the pollen analytical examination of honey samples from the natural habitats of the bee as well as apiaries from various provinces of India (Mitre, 1958; & Nair, 1964).

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Significant melissopalynological works have been reported from different sectors of Telangana state, dealing with pollen analysis of honey (Ramanujam & Kalpana, 19991; & Ramanujam et al., 1992; & Lakshmi & Suryanarayana, 2004). Similar melissopalynological research was conducted in Karnataka (Chauhan & Murthy, 2010; & Shivaram et al., 2012), Bihar (Suryanarayana et al., 1992), Madhya Pradesh (Chauhan & Quamar, 2010), Maharashtra (Deodikar & Thakar, 1953), Uttarakhand (Verma, 1988; Gaur & Nanwani, 1989; & Dixit et al., 2013), Uttar Pradesh (Sharma & Nair, 1965; & Chauhan & Trivedi, 2011), West Bengal (Mondal & Mittre, 1980; & Bhattacharya et al., 1983). Qualitative and quantitative melissopalynological analyses in the eastern coastal regions of India show that these areas have many bee plants that can produce enough monofloral honeys, have a longer period of honey flow and therefore can be used commercially for moderate to large-scale apiculture enterprises (Upadhyay et al., 2014).

The study area includes Nalgonda district in Telangana state, which has a rich source of vegetation of dry deciduous type and is very much congenial for honey production. The present work deals with the pollen analysis of rock bee honey samples collected from the study area with an aim to identify the bee forage plants useful for beekeeping ventures.

## MATERIALS AND METHODS

Four *Apis dorsata* honey samples were collected from various places viz., Devarakonda, Miryalaguda, Nalgonda, and Kanagal of Nalgonda district in Telangana state (Map - 1), which lies 17.0575° N, 79.2684° E. These samples were collected during summer and were processed by using Erdtman's acetolysis technique (1960) to recover the pollen. Qualitative and quantitative pollen analysis were done according to the methodology recommended by the International Commission for Bee Botany (I.C.B.B. Louveaux et al., 1978). Three slides were prepared for each sample, and pollen types were identified based on morphological characters, reference pollen slide collection, and relevant literature. Recorded pollen in these honey samples are classified as predominant pollen type (P > 45%), secondary pollen type (S=16-45%), important minor pollen type (IM= 3-15%) and minor pollen type (M < 3%) based on their frequencies (Louveaux et al., 1978). Honey samples containing more than 45% of a single type of pollen taxa were considered as unifloral/monofloral type of honey. The pollen types' distribution frequency was determined according to Feller and Demalsy 1989. Information regarding sample number, locality, nature and type of honey sample, and season of collection is given in Table 1.

## RESULTS

Squeezed honey samples of *Apis dorsata* bees collected from the Nalgonda district of Telangana State during the summer season were palynologically scanned. All four honey samples studied were found to be unifloral in nature, with *Borassus flabellifer* as the chief nectar source plant. *Lannea coromandel* and *Prosopis juliflora* as important minors, and thirteen pollen types in the minor (<3%) category were recorded in the present study. Grass pollen are the pollen types of non-nectariferous / anemophilous taxa recorded in negligible percentages. Table 2 provides detailed information on all the pollen types recorded in predominant, secondary, important minor and minor categories. The significant pollen types recorded from the honey samples of the present study are illustrated in plates 1 and 2.

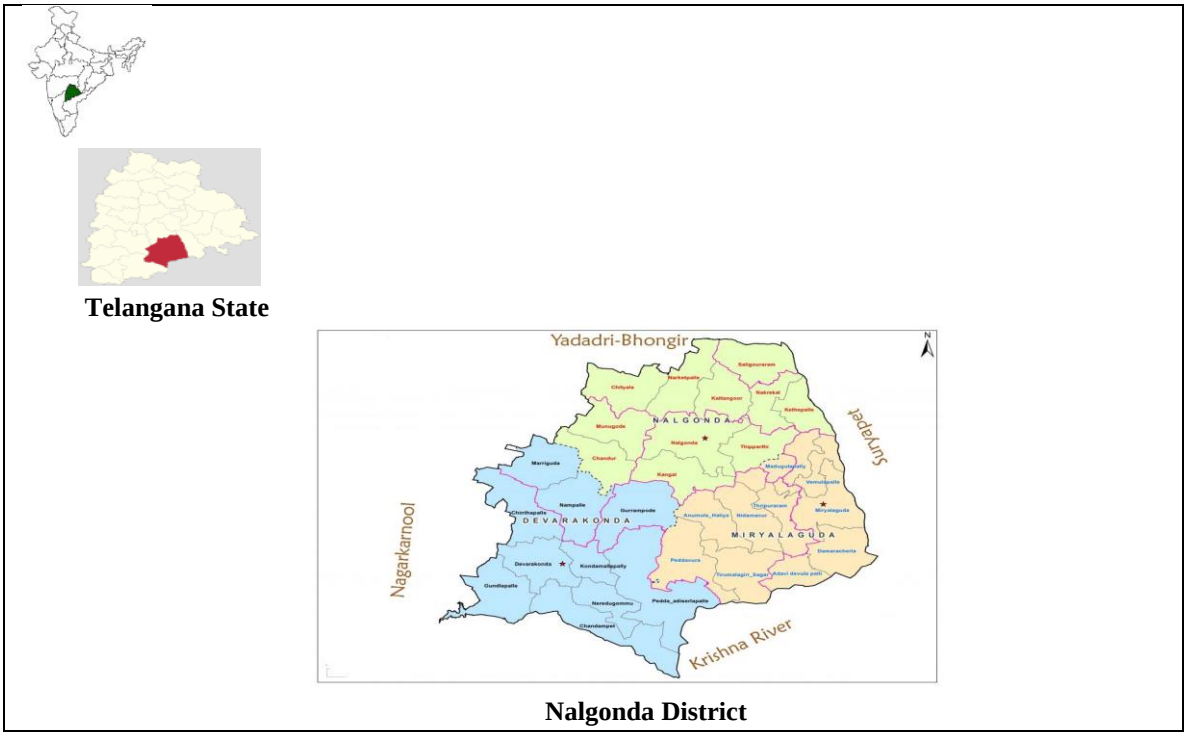
## DISCUSSION

Pollen analysis of four *Apis dorsata* summer honey collected from different localities of Nalgonda state brought to light unifloral honey characterized by the presence of *Borassus flabellifer* as the predominant pollen species. A total of sixteen pollen taxa belonging to twelve families were identified from the *Apis dorsata* summer honey of the Nalgonda district. Of these 3, pollen taxa were referred

to Arecaceae *and Mimosaceae* families, and one taxa to Anacardiaceae, Malvaceae, Meliaceae, Capparaceae, Fabaceae, Rutaceae, Molluginaceae, *Caesalpiniaceae*, Phyllanthaceae and Asteraceae families (Table-3). The pollen of *Borassus flabellifer*, *Albizia lebbeck, Leucaena leucocephala* and *Prosopis juliflora* were recorded as very frequent and the remaining *Cocos nucifera Lannea coromendelica, Phoenix sylvestris, Abutilon indicum, Azadirachta indica, Capparis sp. Delonix regia, Feronia elephantum, Mollugo pentaphylla, Peltophorum pterocarpum, Phyllanthus sp* and *Tridax procumbens* pollen were recorded under frequent class (Text-figure 1).

*Borassus flabellifer*, known as palmyra palm, is native to Southern and Southeast Asia and is seen as a commonly distributed species in this region. *Borassus flabellifer* pollen was recorded in >45% of all the samples studied, and this species contributed as the chief nectar source species for unifloral honey. Ramanujam and Kalpana 1995 studied the honey samples from East Godavari district of Andhra Pradesh and recorded *Borassus flabelliber* as the predominant nectar source for the honey bees. The other noteworthy pollen types viz., *Albizia lebbeck, Leucaena leucocephala, Prosopis Cocos nucifera Lannea coromendelica, Phoenix sylvestris, Abutilon indicum, Azadirachta indica, Capparis sp. Delonix regia, Feronia elephantum, Mollugo pentaphylla, Peltophorum pterocarpum, Phyllanthus sp.* and *Tridax procumbens* recorded as Important minor and minor pollen types in the present study were also reported from the honey samples of Medak (Chaya & Verma, 2004, 2008, 2010), East Godavari (Chaya & Ramchandra reddy, 2011), Khammam (Usha rani et al., 2015a 2015b), and Visakhapatnam (Devender et al., 2014, & Devender & Ramakrishna, 2015) of Andhra Pradesh.

This study highlights that the analysis of honey samples from Nalgonda district recorded all such key bee forage plants as essential nectar sources for the *Apis dorsata* bees. Further ongoing studies may give meaningful and appropriate suggestions in this area for the development of the apiary industry to enhance the honey production in this floristically rich province of Nalgonda district, and in addition, employment opportunities may be generated for rural communities.




**Map 1 - Showing the study area**

**Table 1 Inventory of the honey samples**

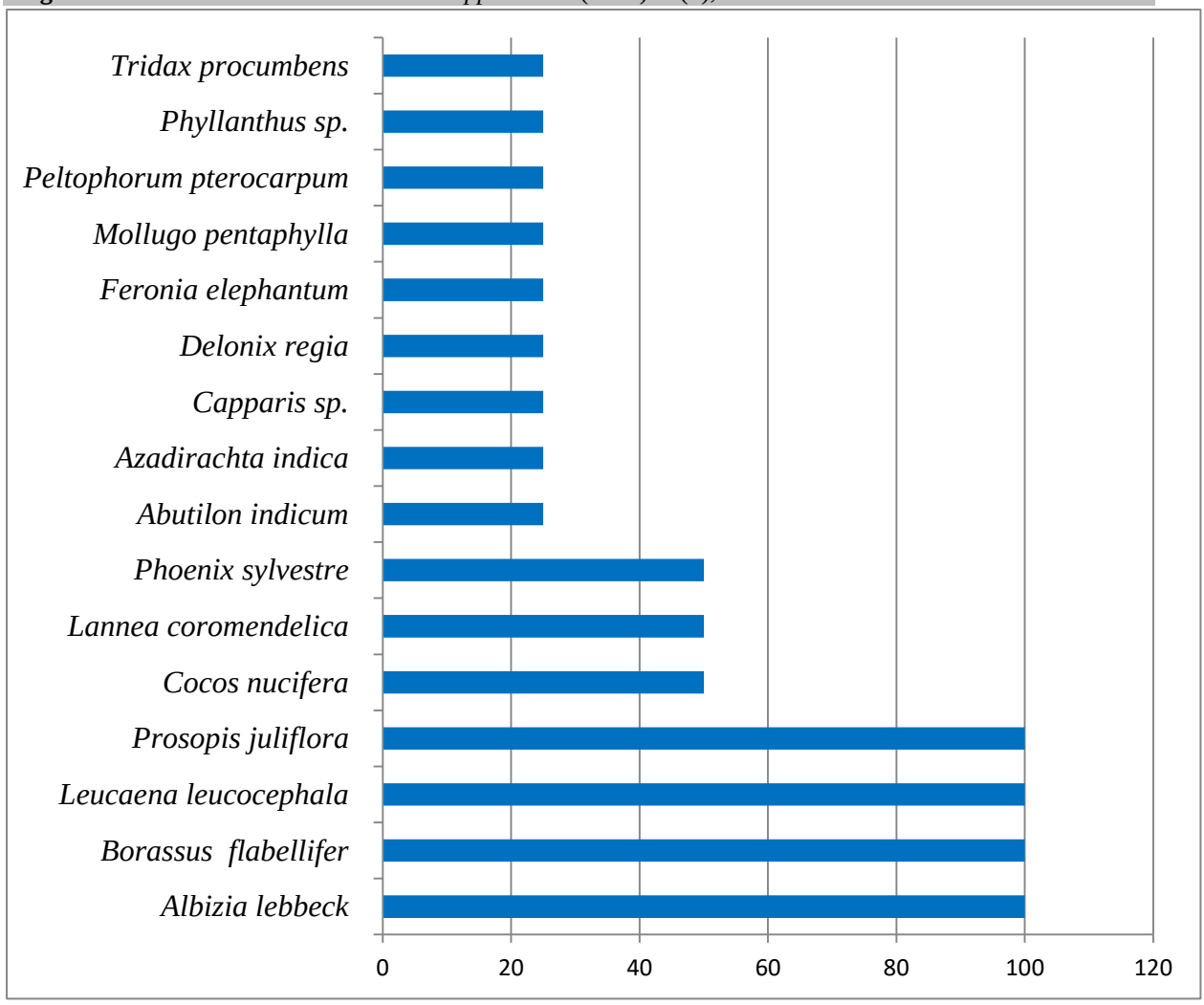
| S. No | Sample code | Locality | Nature of honey | Type of honey | Season collected | Colour of honey | Moisture content |
|---|---|---|---|---|---|---|---|
| 1 | NG-DK-DK-PP-Ad-1 | Devarakonda | Unifloral | Squeezed | Summer | Amber | 20% |
| 2. | NG-MG-MG-TP-Ad-2 | Miryalaguda | Unifloral | Squeezed | Summer | Dark amber | 21% |
| 3. | NG-NG-Ka-RP-Ad-4 | Nalgonda | Unifloral | Squeezed | Summer | Amber | 20% |
| 4 | NG-KA-PG-Ad-5 | Kanagal | Unifloral | Squeezed | Summer | Amber | 22% |

**Table 2 Pollen frequencies recorded from the honey samples studied from the Nalgonda district of Telangana state**

| S. No | Sample code | Nature of honey | Predominant pollen type (> 45%) | Secondary pollen types (16-45%) | Important minor pollen types (3-15%) | Minor pollen types (< 3%) |
|---|---|---|---|---|---|---|
| 1 | NG-DK-DK-PP-Ad-1 | Unifloral | *Borassus flabellifer (78)* | NIL | *Lannea coromendelicana (12)*<br>*Prosopis juliflora (6)* | *Albizia lebbeck (1)*<br>*Leucaena leucocephala (1)*<br>*Phoenix sylvestris (1)*<br>*Feronia elephant (1)* |
| 2 | NG-MG-MG_ TP-Ad-2 | Unifloral | *Borassus flabellifer (70)* | NIL | *Lannea coromendelicana (13)*<br>*Prosopis juliflora (10)* | *Albizia lebbeck (2)*<br>*Phoenix sylvestris (2)*<br>*Cocos nucifera (0.8)*<br>*Leucaena leucocephala (0.8)*<br>*Phyllanthus sp. (0.8)*<br>*Capparis sp. (0.6)* |
| 3 | NG-NG-Ka-RP-Ad-4 | Unifloral | *Borassus flabellifer (79)* | NIL | *Prosopis juliflora (15)* | *Peltophorum pterocarpum (1)*<br>*Leucaena leucocephala (0.8)*<br>*Cocos nucifera (0.8)*<br>*Azadirachta indica (0.8)*<br>*Mollugo pentaphylla (0.8)*<br>*Abutilon indicum (0.6)*<br>*Phyllanthus sp. (0.5)*<br>*Albizia lebbeck (0.5)*<br>*Tridax procumbens (0.2)* |
| 4 | NG-KA-PG-Ad-5 | Unifloral | *Borassus flabellifer (76)* | NIL | *Prosopis juliflora (13)* | *Leucaena leucocephala (5)*<br>*Tridax procumbens (4)*<br>*Albizia lebbeck (1.5)*<br>*Delonix regia (0.5)* |

**Table3. Representation of pollen types in various families in summer honeys of *Apis dorsata***

| S. No | Name of the Family | Name of the Pollen Taxa |
|---|---|---|
| 1. | *Mimosaceae* | *Albizia lebbeck, Leucaena leucocephala, Prosopis juliflora* |
| 2. | Arecaceae | *Borassus flabellifer, Cocos nucifera, Phoenix sylvestris* |
| 3. | Anacardiaceae | *Lannea coromandelica* |
| 4. | Malvaceae | *Abutilon indicum* |
| 5. | Meliaceae | *Azadirachta indica* |
| 6. | Capparaceae | *Capparis* sp. |
| 7. | Fabaceae | *Delonix regia* |
| 8. | Rutaceae | *Feronia elephant* |
| 9. | Molluginaceae | *Mollugo pentaphylla* |
| 10 | *Caesalpiniaceae* | *Peltophorum pterocarpum* |
| 11 | Phyllanthaceae | *Phyllanthus* sp. |
| 12 | Asteraceae | *Tridax procumbens* |




**Text-figure 2 Pollen frequency distribution in honeys of *Apis dorsata* from Nalgonda district**

**Plate – 1: Photomicrographs of the pollen types recorded.**
**(All figures X1000 magnification)**

| | | |
|---|---|---|
|  |  |  |
| *Borassus flabellifer* | *Borassus flabellifer* | *Borassus flabellifer* |

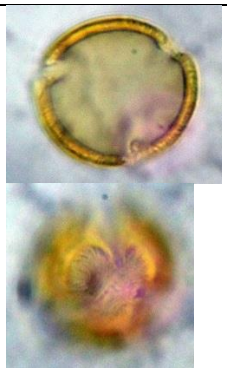
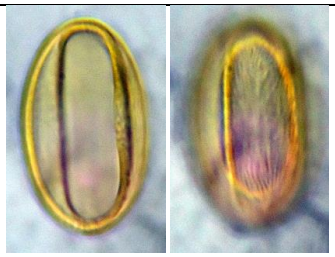
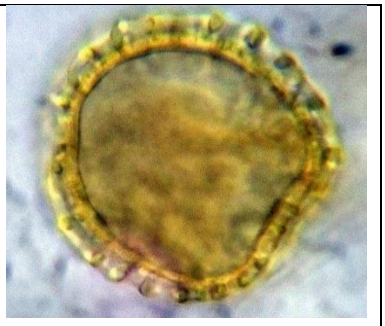
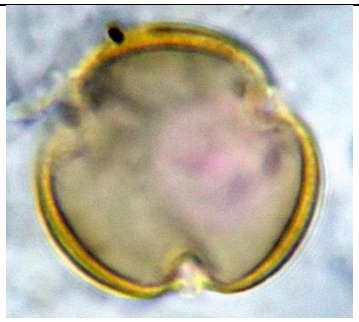
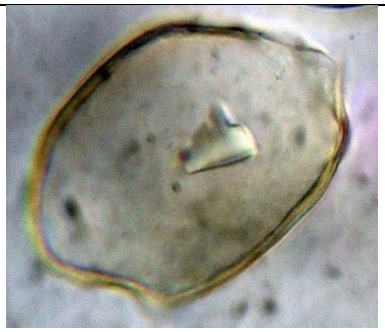
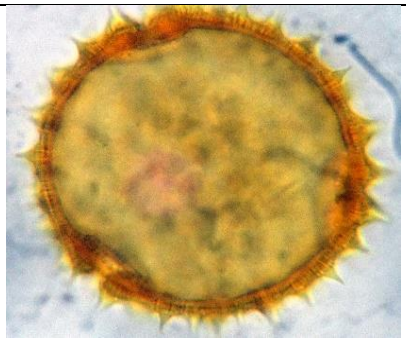
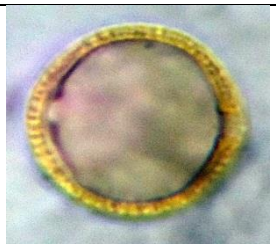
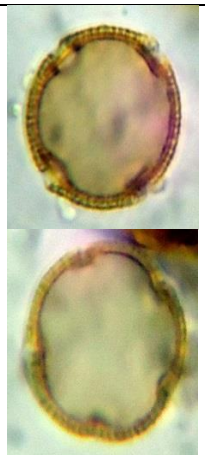
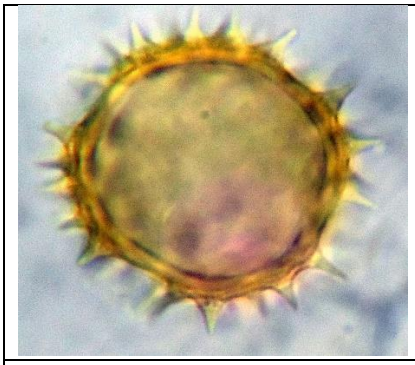
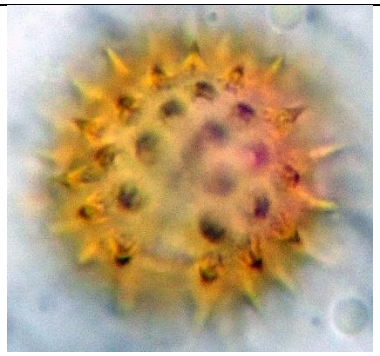
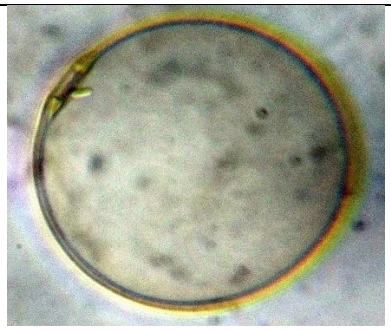
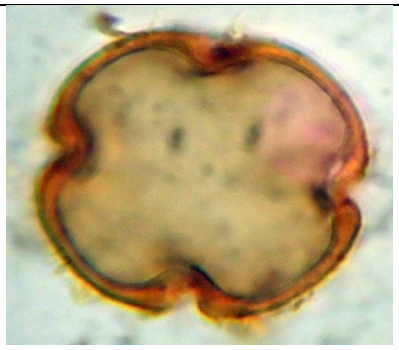
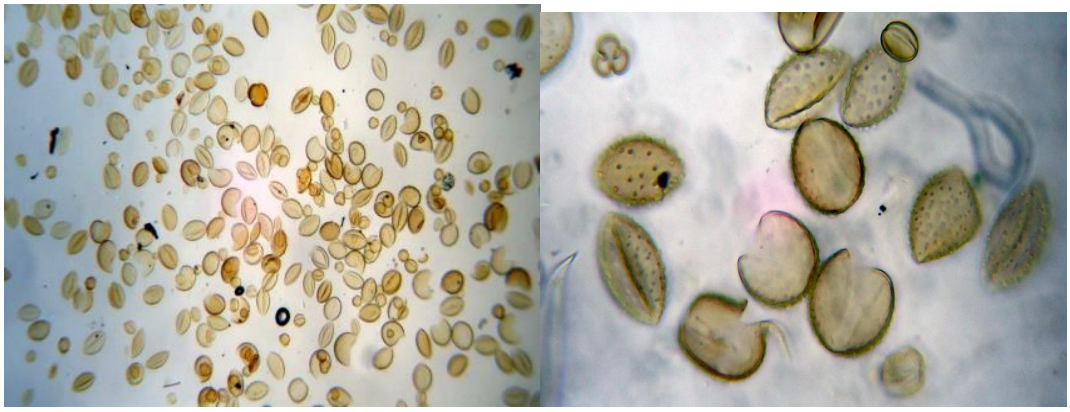
| | | |
|---|---|---|
|  |  |  |
| *Lannea coromandelica P.V.* | *Lannea coromandelica E.V* | *Delonix regia P.V* |
|  |  |  |
| *Prosopis juliflora E.V* | *Prosopis juliflora P.V* | *Leucaena leucocephala E.V* |
|  |  |  |
| *Cocos nucifera* | *Abutilon indicum* | *Leucaena leucocephala P.V,* |

**PLATE-2**

| | | |
|---|---|---|
|  |  |  |
| *Phoenix sylvestris* | *Phyllanthus sp. E..V* | *Phyllanthus sp. P.V* |

| | | |
|---|---|---|
|  |  |  |
| *Tridax procumbens* | *Tridax procumbens* | *Grass pollen* |
|  |  |  |
| *Azadirachta indica P.V* | *Azadirachta indica E.V* | *Albizia lebbeck* |

**Borassus flabellifer (>45%) - unifloral**



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**Conflict of Interest:**
The authors declare that they have no conflict of interest.

**Authors' Contribution:**
Conceptualization, design, data analysis and interpretation of results (CP); Sample collection and pollen slide preparation (CB); Photomicrography (CM).

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