

Nectar source for honey bees during winter season in Medak District of Andhra Pradesh, South India

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ABSTRACT

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Microscopic analysis of the pollen contents of 41 squeezed honeys of *Apis florea* combs, collected during the winter season (November to February) of 2003-2004 and 2004-2005, from 26 villages of 16 mandals of Medak District of Andhra Pradesh, South India, has been carried out. Of these, 26 honey samples were found to be unifloral, whereas the remaining 15 honey samples were multifloral. *Prosopis juliflora* is the predominant pollen type in 9 unifloral honeys, being the chief bee plant occurring frequently in the studied samples. Other significant unifloral winter honeys were of *Eucalyptus globulus*, *Mangifera indica*, *Ageratum coryzoides*, *Sphaeranthus indicus*, *Helianthus annuus*, *Phoenix sylvestris* and *Cleome viscosa*. Andole and Kondapur mandals have yielded majority of unifloral honeys.

Key-words: Melittopalynology, winter honeys, chief nectar source, Medak district, Andhra Pradesh, India.

INTRODUCTION

Melittopalynological studies have significant application in the field of apiculture. Apiculture is essentially based on the close relationship between honey bees and the flowering plants contributing to the profitable cottage industry. Success of commercial beekeeping enterprise depends upon the knowledge of the local flora that provides abundant nectar and pollen sources for the honey bees. Melittopalynological studies in Andhra Pradesh have been carried out by Jhansi and Ramanujam (1986, 1990), Ramanujam and Khatija (1991, 1992, 1993), Ramanujam et al. (1992a, b), Ramanujam and Kalpana (1993, 1994, 1995a, b), Jhansi et al. (1994), Ramanujam (1994a, b), Kalpana and Ramanujam (1998) and Chaya and Varma (2004, 2008). The present study deals with the microscopic analysis of the pollen contents of squeezed honeys and highlights the chief and alternate sources of nectar for honey bees (*Apis florea*).

MATERIAL AND METHOD

Forty one squeezed honey samples (150gm each) of *Apis florea* (little bee) were collected from 26 villages belonging to 16 mandals of Medak District during the winter season (November to February) of 2003-2004 and 2004-2005 (Table 1). Care was taken to squeeze the honey from storing portion of the combs so as to obtain pure honey.

Processing of the material, recovery, analysis and quantification of the pollen contents in a sample were in accordance with the methodology recommended by International Commission for Bee Botany (Louveaux et al. 1978). Three hundred pollen grains were counted at random for determining pollen frequency classes whereas 1200 grains for pollen frequency percentages. The retrieved pollen types were categorized under 4 frequency classes, viz. predominant (>45% of the total pollen compliment of nectariferous taxa), secondary (16-45%), important minor (3-15%) and minor (<3%). The honeys were designated as 'unifloral' when it

contained a predominant pollen type and 'multifloral' when no predominant pollen type is identified. The frequency distribution of pollen types was computed from the number of honey samples in which various pollen types appeared and 4 discrete classes were recognized, viz. very frequent (present in >50% of the samples), frequent (20-50%), infrequent (10-20%) and rare (<10%) (Feller-Demalsy et al. 1987).

OBSERVATIONS

Of the 41 honey samples, 26 samples are found to be unifloral, whereas the remaining 15 samples are multifloral. Of the unifloral honeys, *Prosopis juliflora* (52.6-89.7%) pollen formed the predominant pollen type in 9 samples, *Eucalyptus globulus* (46-72%) in 6 samples, *Mangifera indica* (57% and 60%), *Ageratum conyzoides* (50.6% and 63%), *Sphaeranthus indicus* (51.92% and 54.6%), *Helianthus annuus* (74.83% and 79.1%) and *Phoenix sylvestris* (82.3% and 84%) in 2 samples each and *Cleome viscosa* (66.2%) in one sample only.

Brassica nigra, *Guizotia abyssinica*, *Eucalyptus globulus*, *Phoenix sylvestris*, *Carthamus tinctorius*, *Carum copticum*, *Prosopis spicigera*, *Sphaeranthus indicus*, *Coriandrum sativum*, *Prosopis juliflora*, *Mangifera indica*, *Helianthus annuus*, *Ocimum basilicum*, *Aspidopterys indica*, *Ageratum conyzoides* and *Commelina bengalensis* constitute secondary pollen types in the studied multifloral honeys. Table 2 provides information with regard to the predominant, secondary and important minor pollen types in the samples collected during November to February period. Fifty four pollen types were encountered under minor types in the total contingent of collected honey samples represented by <3% (Table 3). The characteristic pollen types from the involved bee plants from the winter honeys of Medak district are illustrated (Plates 1 and 2).

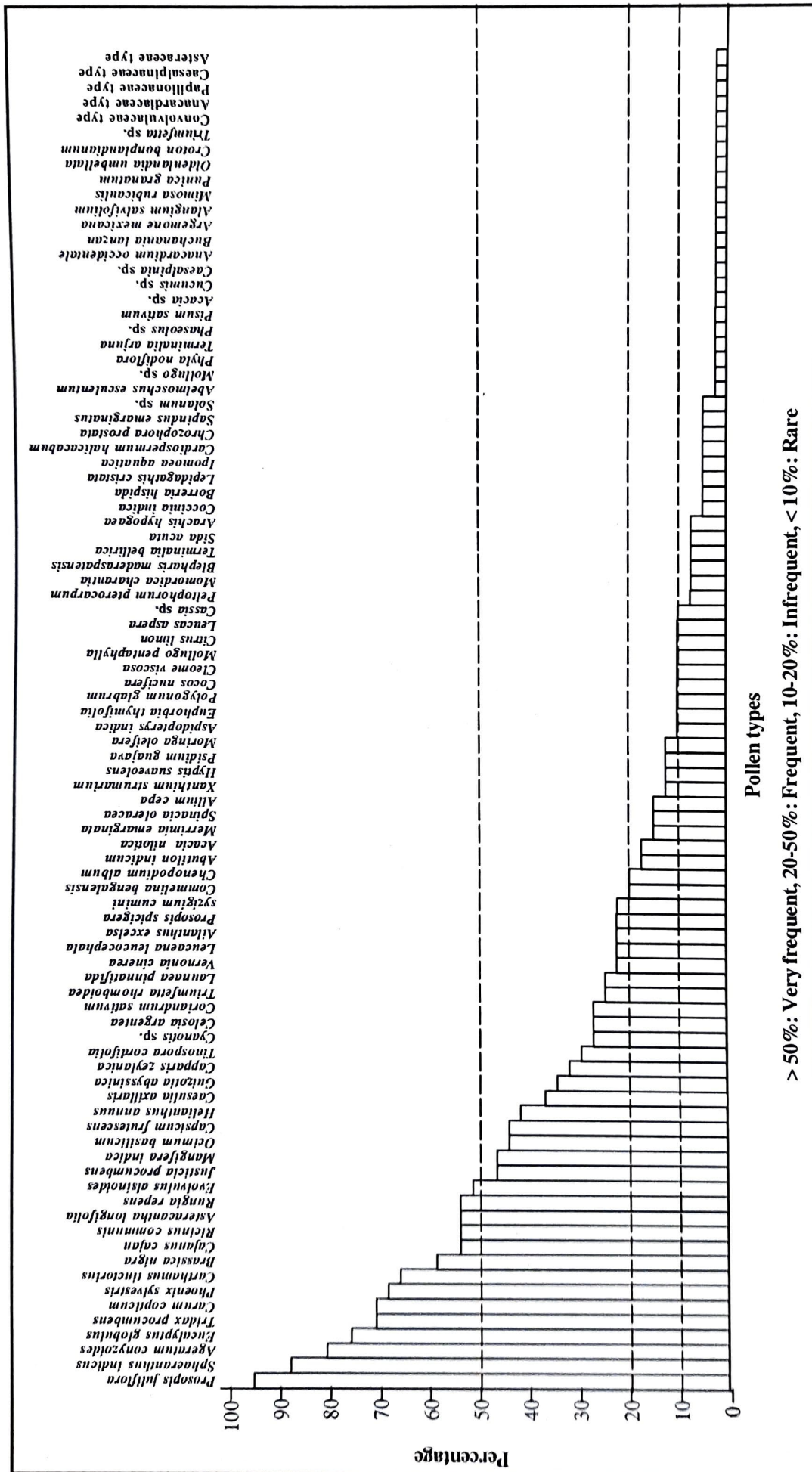
On the whole, 90 pollen types of nectariferous taxa, referable to 36 families, were recognized in the studied honey samples (Table 4). Of these, 18 samples yielded 21-30 pollen types, 16 samples 11-20 pollen types, 4 samples 6-10 pollen types and 3 samples >30 pollen types. The sample MDR-20a from Raipole village of

Daulathabad mandal showed the maximum number of pollen types (34) whereas sample MAM-5a from Masanpalli of Andole mandal had minimum number of pollen types (6).

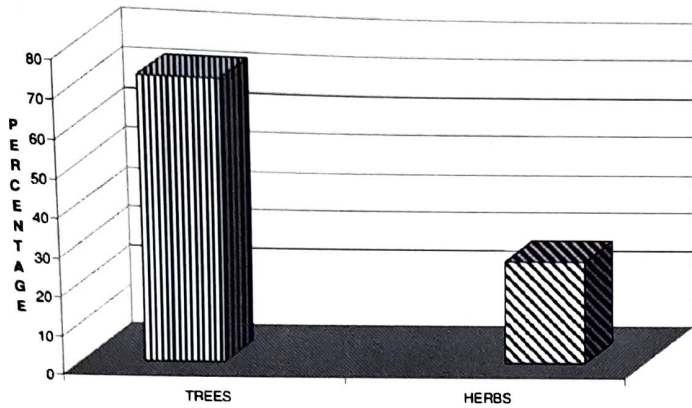
Based on the frequency of occurrence of pollen types in various honeys, 4 classes could be recognized. Of the 90 pollen types of nectariferous taxa encountered in winter honeys, 14 pollen types, viz. *Prosopis juliflora*, *Sphaeranthus indicus*, *Ageratum conyzoides*, *Eucalyptus globulus*, *Tridax procumbens*, *Carum copticum*, *Phoenix sylvestris*, *Carthamus tinctorius*, *Brassica nigra*, *Cajanus cajan*, *Ricinus communis*, *Asteracantha longifolia*, *Rungia repens*, and *Evolvulus alsinoides* belong to "very frequent" type, 19 pollen types "frequent", 11 to "infrequent" and 46 to "rare" type, (Text-figure 1). *Prosopis juliflora* is the only pollen type which is recorded in more than 95 % of the samples studied. However, pollen of *Sphaeranthus indicus* and *Ageratum conyzoides* were recorded in >80% of the samples studied. The encountered pollen types of non-nectariferous taxa, viz. *Sorghum vulgare*, *Achyranthus* sp., *Oryza sativa*, *Zea mays*, *Cyperus rotundus*, *Typha angustata*, *Casuarina equisetifolia* and grass pollen in minor percentages in the honeys represent wind borne contaminants in the hives of *Apis florea*.

DISCUSSION

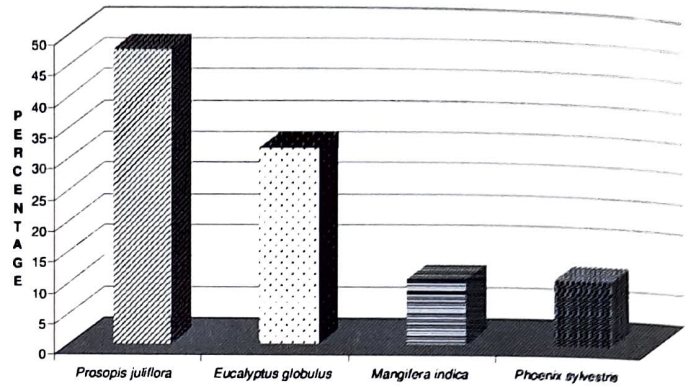
The present study involves qualitative as well as quantitative analysis of the pollen contents of 41 winter honeys from *Apis florea* combs collected from various localities in Medak District, Andhra Pradesh. Eight pollen types, viz. *Prosopis juliflora*, *Eucalyptus globulus*, *Mangifera indica*, *Ageratum conyzoides*, *Sphaeranthus indicus*, *Helianthus annuus*, *Phoenix sylvestris* and *Cleome viscosa*, are designated as predominant pollen types from 26 unifloral honeys. In these unifloral honeys, *Prosopis juliflora* constituted the predominant pollen type in 9 samples (34.6%) and *Eucalyptus globulus* in 6 samples (23.1%), *Mangifera indica*, *Ageratum conyzoides*, *Sphaeranthus indicus*, *Helianthus annuus* and *Phoenix sylvestris* in 2 samples each (7.7%) and *Cleome viscosa* in 1 sample (3.8%).



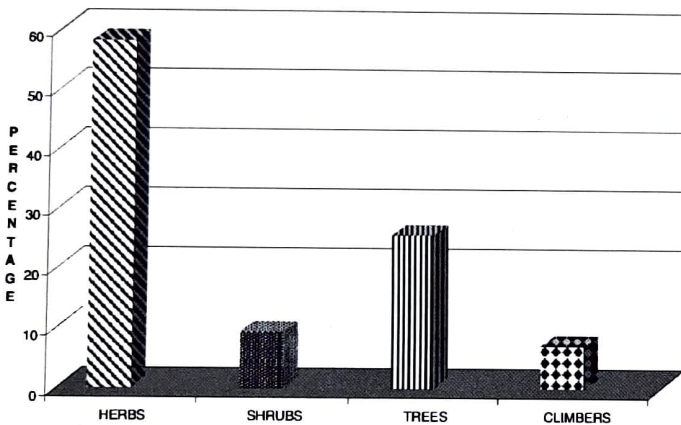
Text-figure 1. Frequency of occurrence of pollen types of melliferous taxa encountered in the winter honeys



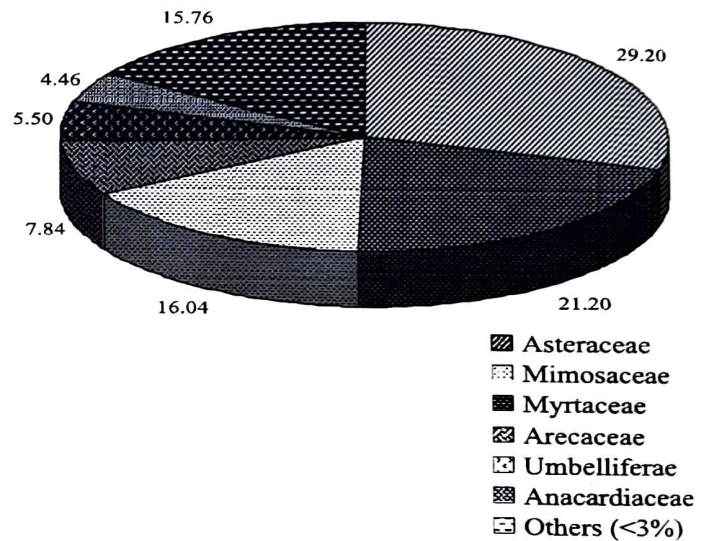
Text-figure 2. Histogram showing numerical frequency of unifloral honeys of trees and herbs recorded from winter honeys.



Text-figure 3. Histogram showing numerical frequency of unifloral honeys of various tree members recorded from winter honeys.



Text-figure 4. Histogram showing numerical frequency of herbs, shrubs, trees and climbers represented by their pollen in winter honeys.



Text-figure 5. Composite spectrum of frequencies of families (>3%) in the winter honey samples.

The bulk of the unifloral honeys had their nectar source in the tree members, i.e. 19 samples (73.1%) out of 26 unifloral honeys. The rest of the unifloral honeys, i.e. in 7 samples (26.9%) originated from herbs (Text-figure 2). *Prosopis juliflora* formed the unifloral predominant pollen type in 9 (47.4%) samples, *Eucalyptus globulus* in 6 (31.6%) samples and *Mangifera indica* and *Phoenix sylvestris* in 2 (10.5%) samples each (Text-figure 3).

Other important nectar sources (represented by 10% or more in the pollen spectrum of each sample) were *Brassica nigra*, *Guizotia abyssinica*, *Carum copticum*, *Tridax procumbens*, *Sphaeranthus indicus*, *Prosopis spicigera*, *Eucalyptus globulus*, *Phoenix sylvestris*, *Carthamus tinctorius*, *Prosopis*

juliflora, *Syzygium cumini*, *Caesulia axillaris*, *Ageratum conyzoides*, *Coriandrum sativum*, *Mollugo pentaphylla*, *Mangifera indica*, *Helianthus annuus*, *Ocimum basilicum*, *Aspidopterys indica*, *Justicia procumbens* and *Commelina bengalensis*.

In the total contingent of honey samples, pollen of herbaceous taxa (58.14%) are better represented compared to pollen of tree members (25.60%), shrubs (9.30%) and climbers (6.98%) (Text-figure 4). Number of herbaceous elements, which bloom profusely after monsoon, provided major as well as minor sources of nectar to *Apis florea* bees during winter.

Asteraceae (29.2%), Mimosaceae (21.2%), Myrtaceae (16.07%), Arecaceae (7.84%), Apiaceae (5.50%) are the significant families as evidenced by the

Table 1. Inventory and nature of honey samples during winter (November-February)

Sample No.	Mandal	Village	Date of Collection	Nature of honey
MKG-1a	Kondapur	Girmapur	08.11.03	Multifloral
MKM-2a	Kondapur	Malkapur	11.12.03	Unifloral <i>Prosopis</i>
MKM-2b	Kondapur	Malkapur	11.12.03	Unifloral <i>Prosopis</i>
MKK-3a	Kondapur	Kondapur	06.12.04	Unifloral <i>Prosopis</i>
MKK-3b	Kondapur	Kondapur	06.12.04	Unifloral <i>Prosopis</i>
MKK-3c	Kondapur	Kondapur	06.12.04	Multifloral
MKT-4a	Kondapur	Togurpally	12.01.05	Multifloral
MAM-5a	Andole	Masanpalli	16.12.03	Unifloral <i>Prosopis</i>
MAA-6a	Andole	Andole	02.01.04	Multifloral
MAA-6b	Andole	Andole	02.01.04	Unifloral <i>Eucalyptu.</i>
MAA-6c	Andole	Andole	05.12.04	Unifloral <i>Prosopis</i>
MAJ-7a	Andole	Jogipet	05.12.04	Unifloral <i>Eucalyptus</i>
MAJ-7b	Andole	Jogipet	05.12.04	Unifloral <i>Ageratum</i>
MPR-8a	Patancheru	Rudrarum	30.12.03	Multifloral
MPR-8b	Patancheru	Rudrarum	11.01.04	Unifloral <i>Mangifera</i>
MPL-9a	Patancheru	Lakdarum	14.11.04	Unifloral <i>Prosopis</i>
MPP-10a	Patancheru	Patancheru	14.11.04	Multifloral
MPP-10b	Patancheru	Patancheru	06.01.05	Multifloral
MSG-11a	Sadasivpet	Gollaguda	02.11.03	Unifloral <i>Ageratum</i>
MSS-12a	Sadasivpet	Sadasivpet	04.01.05	Unifloral <i>Sphaeranthus</i>
MSS-12b	Sadasivpet	Sadasivpet	04.01.05	Unifloral <i>Prosopis</i>
MGA-13a	Gajwel	Akkaram	03.01.04	Unifloral <i>Helianthus</i>
MGP-14a	Gajwel	Pragnapur	04.01.05	Unifloral <i>Cleome</i>
MGG-15a	Gajwel	Gajwel	04.01.05	Unifloral <i>Prosopis</i>
MNN-16a	Narsapur	Narsapur	18.01.05	Unifloral <i>Phoenix</i>
MNN-16b	Narsapur	Narsapur	18.01.05	Unifloral <i>Eucalyptus</i>
MNN-16c	Narsapur	Narsapur	18.01.05	Unifloral <i>Phoenix</i>
MSaK-17a	Sangareddy	Kandi	21.11.03	Multifloral
MSaK-17b	Sangareddy	Kandi	21.11.03	Unifloral <i>Mangifera</i>
MHM-18a	Hathnura	Mangapuram	17.02.04	Multifloral
MHM-18b	Hathnura	Mangapuram	17.02.04	Unifloral <i>Sphaeranthus</i>
MZZ-19a	Zaheerabad	Zaheerabad	09.12.04	Unifloral <i>Helianthus</i>
MZZ-19b	Zaheerabad	Zaheerabad	09.12.04	Unifloral <i>Eucalyptus</i>
MDR-20a	Daulathabad	Raipole	12.01.05	Multifloral
MDR-20b	Daulathabad	Raipole	12.01.05	Multifloral
MRR-21a	Ramchandrapuram	Ramchandrapuram	01.12.03	Multifloral
MJT-22a	Jagadevpur	Teegul	06.12.04	Multifloral
MShSh-23a	Shankarampet	Shankarampet	03.01.05	Unifloral <i>Eucalyptus</i>
MPuM-24a	Pulkal	Muddayipet	03.01.05	Unifloral <i>Eucalyptus</i>
MJiG-25a	Jinnaram	Gummadidala	03.01.05	Multifloral
MNaG-26a	Nangnur	Ganapuram	02.02.05	Multifloral

number of species in the analysed total honey samples merit the status of principal sources of nectar for honey production in Medak district (Text-figure 5).

The importance of a taxon as a geographical or regional indicator is taken on the basis of frequency of the occurrence of its pollen in the total contingent of honey samples. (Kalpana & Ramanujam 1998). *Prosopis juliflora*, *Sphaeranthus indicus*, *Ageratum conyzoides*, *Eucalyptus globulus*, *Tridax procumbens* and *Carum copticum* complex, the pollen

grains of which are encountered in >70% of the honeys studied, represent existing local or regional indicators of honeys collected from Medak District.

Most of the predominant pollen types, viz. *Prosopis juliflora*, *Eucalyptus globulus*, *Mangifera indica*, *Ageratum conyzoides*, *Sphaeranthus indicus*, *Helianthus annuus* and *Phoenix sylvestris* recorded as secondary, important minor and minor pollen types occurred 'very frequently' with the exception of *Mangifera indica* and *Helianthus annuus* occurring

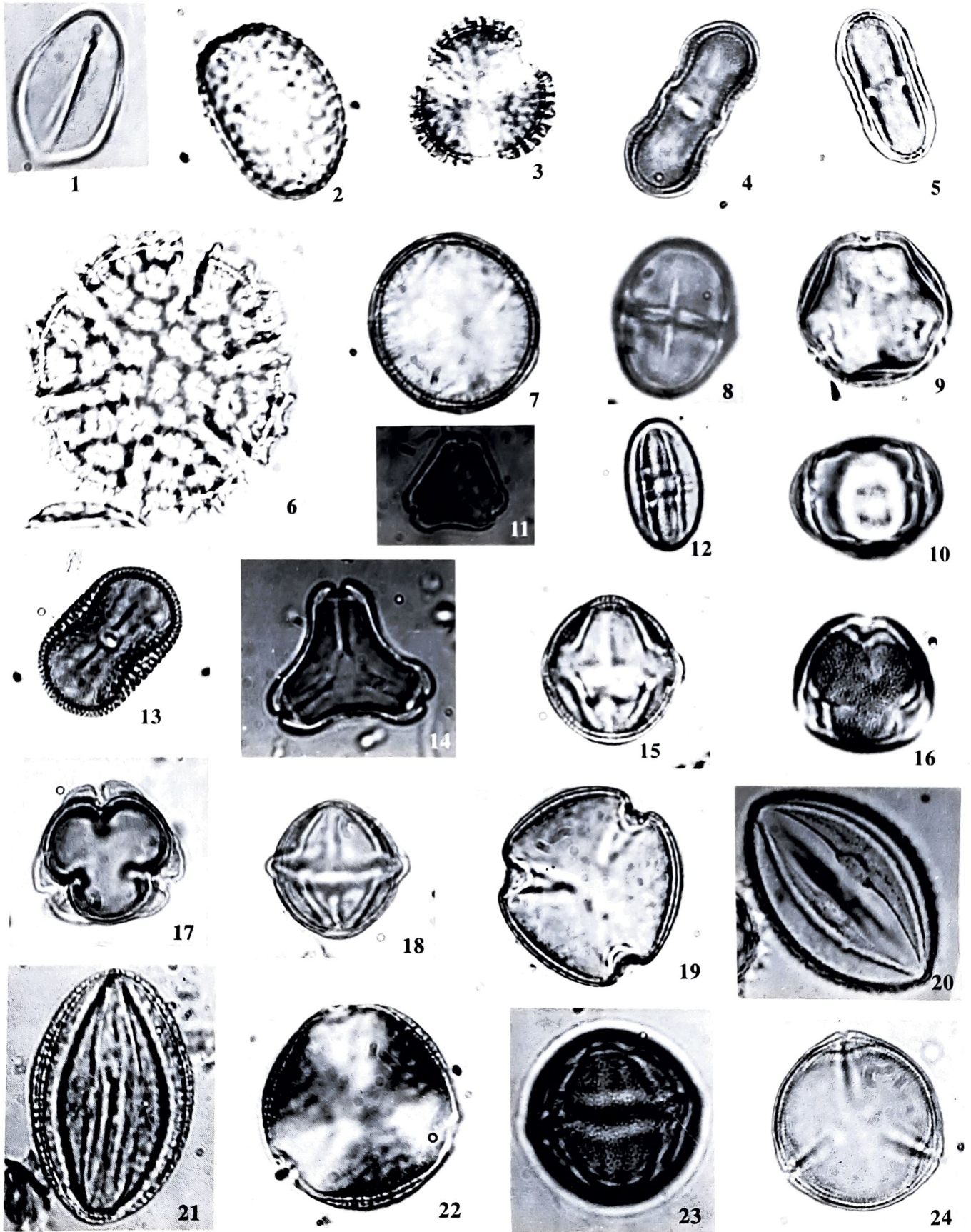


Plate 1

All figures are magnified x1000

1. *Phoenix sylvestris*, 2. *Commelina bengalensis*, 3. *Brassica nigra*, 4. *Coriandrum sativum*, 5. *Carum copticum*, 6. *Ocimum basilicum*, 7. *Evolvulus alsinoides*, 8. *Phyla nodiflora*, 9-10. *Ailanthus excelsa*, 11. *Syzygium cumini*, 12. *Cleome viscosa*, 13. *Justicia procumbens*, 14. *Eucalyptus globulus*, 15-16. *Mangifera indica*, 17-18. *Capsicum frutescens*, 19-20. *Prosopis juliflora*, 21-22. *Prosopis spicigera*, 23-24. *Ricinus communis*.

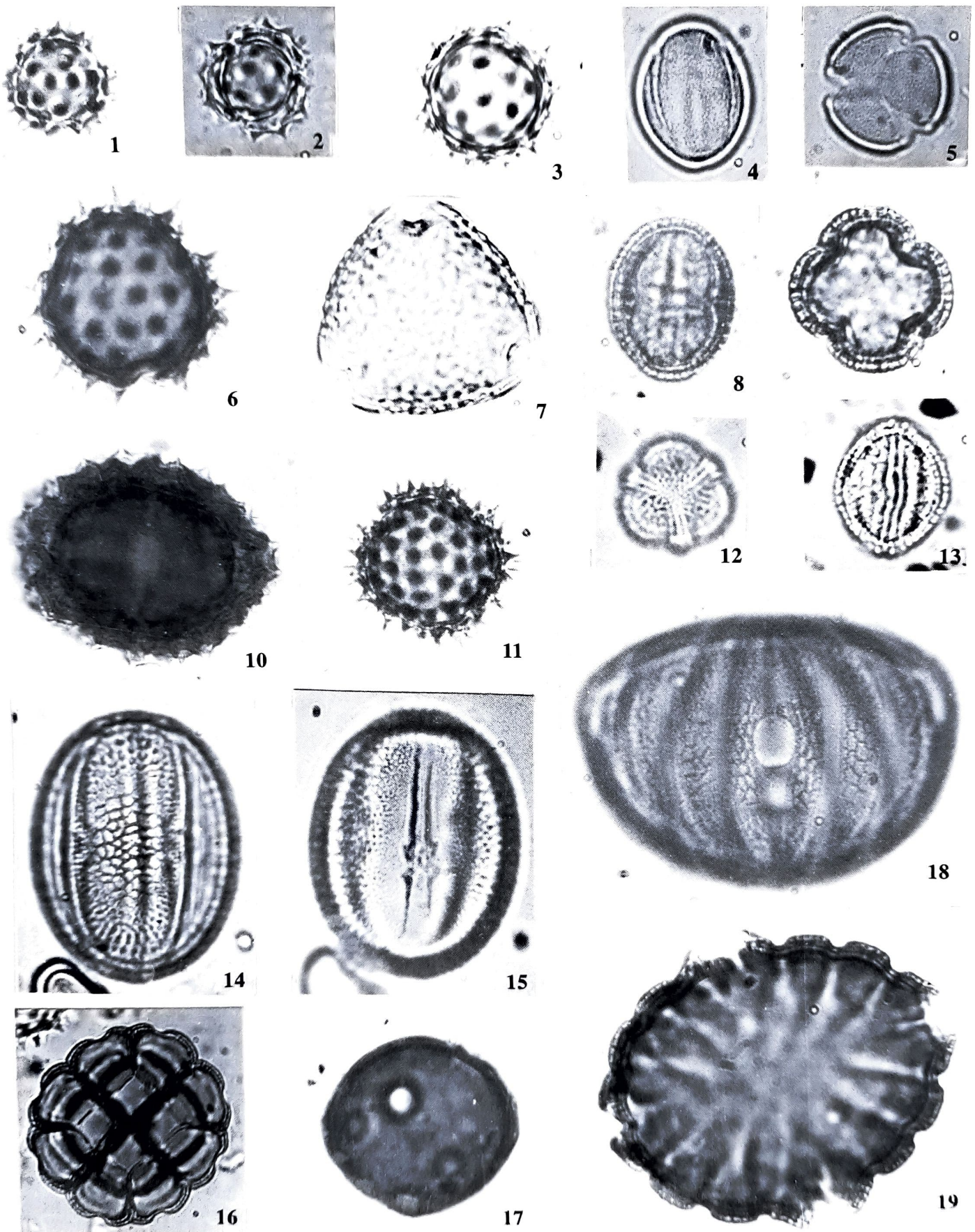


Plate 2

All figures are magnified x1000, unless otherwise mentioned.

1. *Sphaeranthus indicus*, 2. *Ageratum conyzoides*, 3. *Gulzotia abyssinica*, 4-5. *Leucas aspera*, 6. *Helianthus annuus*, 7. *Cajanus cajan*, 8-9. *Citrus limon*, 10. *Carthamus tinctorius* (x750), 11. *Tridax procumbens*, 12-13. *Tinospora cordifolia*, 14-15. *Coccinia indica*, 16. *Acacia nilotica* (x750), 17. *Aspidopterys indica*, 18-19. *Asteracantha longifolia*.

Table 2. Significant pollen types recorded from Medak District honeys (November-February 2003-2005)

Predominant Pollen Types (>45%)	Secondary Pollen Types (16-45%)	Important Minor Pollen Types (3-15%)
<i>Prosopis juliflora</i>	<i>Brassica nigra</i>	<i>Carum copticum</i>
<i>Eucalyptus globules</i>	<i>Guizotia abyssinica</i>	<i>Tridax procumbens</i>
<i>Mangifera indica</i>	<i>Eucalyptus globulus</i>	<i>Capsicum frutescens</i>
<i>Ageratum conyzoides</i>	<i>Phoenix sylvestris</i>	<i>Evolvulus alsinoides</i>
<i>Sphaeranthus indicus</i>	<i>Carthamus tinctorius</i>	<i>Caesulia axillaris</i>
<i>Helianthus annuus</i>	<i>Carum copticum</i>	<i>Mangifera indica</i>
<i>Phoenix sylvestris</i>	<i>Sphaeranthus indicus</i>	<i>Sphaeranthus indicus</i>
<i>Cleome viscosa</i>	<i>Coriandrum sativum</i>	<i>Tinospora cordifolia</i>
	<i>Prosopis juliflora</i>	<i>Prosopis spicigera</i>
	<i>Mangifera indica</i>	<i>Syzygium cumini</i>
	<i>Helianthus annuus</i>	<i>Carthamus tinctorius</i>
	<i>Ocimum basilicum</i>	<i>Brassica nigra</i>
	<i>Aspidopterys indica</i>	<i>Helianthus annuus</i>
	<i>Ageratum conyzoides</i>	<i>Phoenix sylvestris</i>
	<i>Commelina bengalensis</i>	<i>Prosopis juliflora</i>
	<i>Prosopis spicigera</i>	<i>Ageratum conyzoides</i>
		<i>Capparis zeylanica</i>
		<i>Moringa oleifera</i>
		<i>Cajanus cajan</i>
		<i>Eucalyptus globulus</i>
		<i>Citrus limon</i>
		<i>Ricinus communis</i>
		<i>Coriandrum sativum</i>
		<i>Mollugo pentaphylla</i>
		<i>Phylla nodiflora</i>
		<i>Cyanotis sp.</i>
		<i>Justicia procumbens</i>
		<i>Commelina bengalensis</i>
		<i>Cassia sp.</i>
		<i>Asteracantha longifolia</i>
		<i>Euphorbia thymifolia</i>
		<i>Guizotia abyssinica</i>
		<i>Leucas aspera</i>
		<i>Cleome viscosa</i>

Table 3. Pollen recorded as Minor Types (<3%)

Abelmoschus esculentum, *Abutilon indicum*, *Acacia nilotica*, *Acacia sp.*, *Ailanthus excelsa*, *Alangium salvifolium*, *Allium cepa*, *Anacardiaceae* type, *Anacardium occidentale*, *Arachis hypogaea*, *Argemone mexicana*, *Asteraceae* type, *Blepharis maderaspatensis*, *Borreria hispida*, *Buchanania lanzan*, *Caesalpiniaceae* type, *Caesalpinia sp.*, *Cardiospermum helicacabum*, *Celosia argentea*, *Chenopodium album*, *Chrozophora prostrata*, *Coccinia indica*, *Cocos nucifera*, *Convolvulaceae* type, *Cucumis sp.*, *Croton bonplandianum*, *Hyptis suaveolens*, *Ipomoea aquatica*, *Launaea pinnatifida*, *Lepidagathis cristata*, *Leucaena leucocephala*, *Merrimia emarginata*, *Mimosa rubicaulis*, *Mollugo sp.*, *Momordica charantia*, *Oldenlandia umbellata*, *Papilionaceae* type, *Peltophorum pterocarpum*, *Phaseolus sp.*, *Pisum sativum*, *Polygonum glabrum*, *Psidium guajava*, *Punica granatum*, *Rungia repens*, *Sapindus emarginatus*, *Sida acuta*, *Solanum sp.*, *Spinacia oleracea*, *Terminalia arjuna*, *Terminalia belirica m.*, *Triumfetta rhomboidea*, *Triumfetta sp.*, *Vernonia cinerea*, *Xanthium strumarium*

only 'frequently'.

Andole and Kondapur mandals have yielded the bulk of unifloral honeys in the present study, and of these *Prosopis* honeys are predominant. In view of this,

these two mandals merit special attention in any future beekeeping enterprise, involving Medak District.

ACKNOWLEDGEMENT

The authors are grateful to Professor C. G. K.

Table 4. Representation of various families in Medak District Honeys

Family	Pollen types in honey samples
Acanthaceae	<i>Asteracantha longifolia</i> , <i>Rungia repens</i> , <i>Justicia procumbens</i> , <i>Blepharis maderaspatensis</i> , <i>Lepidagathis cristata</i>
Alangiaceae	<i>Alangium salvifolium</i>
Amaranthaceae	<i>Celosia argentea</i>
Anacardiaceae	<i>Mangifera indica</i> , <i>Anacardium occidentale</i> , <i>Buchanania lanzan</i> , Anacardiaceae type
Apiaceae	<i>Carum copticum</i> , <i>Coriandrum sativum</i>
Areaceae	<i>Phoenix sylvestris</i> , <i>Cocos nucifera</i>
Asteraceae	<i>Sphaeranthus indicus</i> , <i>Ageratum conyzoides</i> , <i>Tridax procumbens</i> , <i>Carthamus tinctorius</i> , <i>Helianthus annuus</i> , <i>Caesulia axillaris</i> , <i>Guizotia abyssinica</i> , <i>Launaea pinnatifida</i> , <i>Vernonia cinerea</i> , <i>Xanthium strumarium</i> , Asteraceae type
Brassicaceae	<i>Brassica nigra</i>
Caesalpiniaceae	<i>Cassia</i> sp., <i>Peltophorum pterocarpum</i> , <i>Caesalpinia</i> sp., Caesalpiniaceae type
Capparidaceae	<i>Capparis zeylanica</i> , <i>Cleome viscosa</i>
Chenopodiaceae	<i>Chenopodium album</i> , <i>Spinacia Oleracea</i>
Combretaceae	<i>Terminalia belirica</i> , <i>Terminalia arjuna</i>
Commelinaceae	<i>Cyanotis</i> sp., <i>Commelina bengalensis</i>
Convolvulaceae	<i>Evolvulus alsinoides</i> , <i>Merrimia emarginata</i> , <i>Ipomoea aquatica</i> , Convolvulaceae type.
Cucurbitaceae	<i>Momordica charantia</i> , <i>Coccinia indica</i> , <i>Cucumis</i> sp.
Euphorbiaceae	<i>Ricinus communis</i> , <i>Euphorbia thymifolia</i> , <i>Chrozophora prostata</i> , <i>Croton bonplandianum</i> .
Lamiaceae	<i>Ocimum basilicum</i> , <i>Hyptis suaveolens</i> , <i>Leucas aspera</i>
Liliaceae	<i>Allium cepa</i>
Malphiaceae	<i>Aspidopterys indica</i>
Malvaceae	<i>Abutilon indicum</i> , <i>Sida acuta</i> , <i>Abelmoschus esculentum</i>
Menispermaceae	<i>Tinospora cordifolia</i>
Mimosaceae	<i>Leucaena leucocephala</i> , <i>Prosopis juliflora</i> , <i>Prosopis spicigera</i> , <i>Acacia nilotica</i> , <i>Acacia</i> sp., <i>Mimosa rubicaulis</i>
Molluginaceae	<i>Mollugo pentaphylla</i> , <i>Mollugo</i> sp.
Moringaceae	<i>Moringa oleifera</i>
Myrtaceae	<i>Eucalyptus globulus</i> , <i>Syzygium cumini</i> , <i>Psidium guajava</i> .
Papavaraceae	<i>Argemone mexicana</i>
Papilionaceae	<i>Cajanus cajan</i> , <i>Arachis hypogaea</i> , <i>Phaseolus</i> sp., <i>Pisum sativum</i> , Papilionaceae type
Polygonaceae	<i>Polygonum glabrum</i>
Punicaceae	<i>Punica granatum</i>
Rubiaceae	<i>Borreria hispida</i> , <i>Oldenlandia umbellata</i>
Rutaceae	<i>Citrus limon</i>
Sapindaceae	<i>Sapindus emarginatus</i> , <i>Cardiospermum helicacabum</i>
Simaroubaceae	<i>Ailanthus excelsa</i>
Solanaceae	<i>Capsicum frutescens</i> , <i>Solanum</i> sp.
Verbenaceae	<i>Phyla nodiflora</i>
Tiliaceae	<i>Triumfetta rhomboidea</i> , <i>Triumfetta</i> sp.

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