

Nectar source for honey bees during summer in Medak District, Andhra Pradesh, India

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Pollen characterization of 22 squeezed honey samples of *Apis florea* (small bee) collected during the summer months of 1996 and 1997 from different localities of Medak District, Andhra Pradesh was carried out. Of the 22 honey samples, 10 samples (45.4%) were found to be unifloral and the remaining 12 (54.5%), multifloral. The unifloral honeys were represented by *Sphaeranthus indicus*, *Lannea coromandelica*, *Prosopis julifera*, *Eucalyptus globulus*, and *Feronia elephantum*. The other significant pollen types recorded upto secondary pollen type (16-45%) include, *Helianthus annuus*, *Sapindus emarginatus*, *Lannea coromandelica*, *Phoenix sylvestris*, *Eucalyptus globulus*, *Terminalia arjuna*, *Careya arorea*, *Psidium guajava*, *Capsicum frutescens*, *Prosopis juliflora*, *Sphaeranthus indicus*, *Brassica nigra*, *Carum copticum* and *Coriandrum sativum*.

Key-words—Nectar source, *Apis florea* bees, Summer honeys, Medak District, Andhra Pradesh, India.

INTRODUCTION

The present study deals with a microscopic analysis of pollen contents of 22 squeezed honeys of *Apis florea* combs collected during summer from various localities of Medak District of Andhra Pradesh and highlights the chief and significant sources of nectar (Map-I).

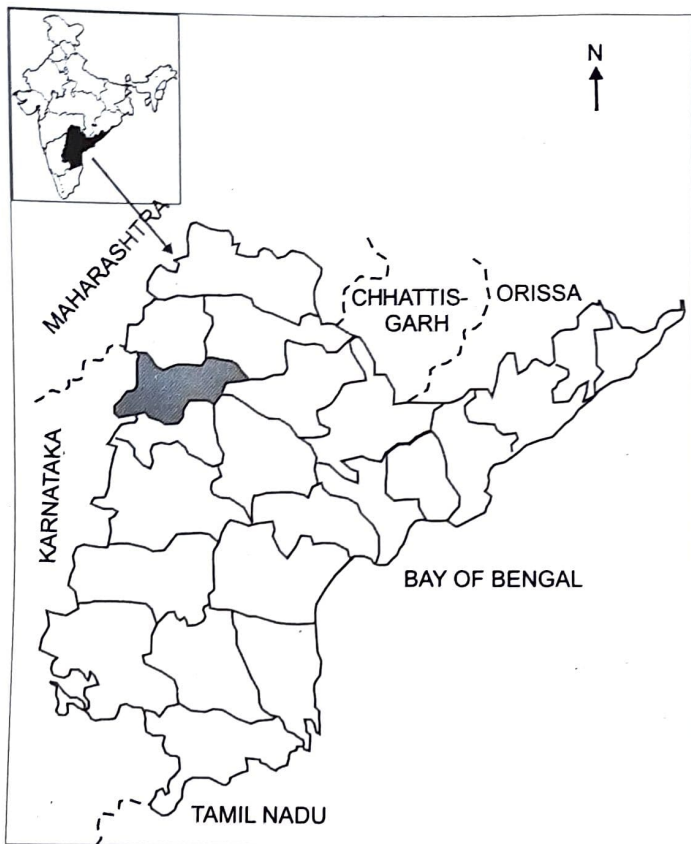
Twenty two samples of honey (squeezed) of *Apis florea* combs were collected from 17 villages belonging to 11 mandals (Table-1) of Medak District during the summer months (March-May) of 1996 and 1997. To the extent possible only the honey storing portion of the combs were subjected to squeezing for obtaining essentially pure honey.

The methodology recommended by the International Commission for Bee Botany (Louveaux *et al.*, 1978) was employed for the recovery, analysis and quantification of the pollen contents of the honey samples studied. 300 pollen grains were counted at random for determining the pollen frequency classes and 1200 grains for pollen frequency percentages. The recovered pollen types were placed under 4 frequency classes viz., Predominant pollen type (>45% of the total pollen compliment of nectariferous taxa), Secondary pollen types (16-45%), Important minor pollen types (3-15%) and Minor pollen types (<3%). All such honeys containing a predominant pollen type were designated as 'unifloral' and those lacking a predominant pollen type as 'multifloral' honeys.

The frequency of occurrence of pollen types (Feller-Demalsy *et al.*, 1987) was determined from the total number of honey samples in which the pollen types appeared and 4 discrete classes were recognized viz., 'Very frequent' (>50%), 'Frequent' (20-50%), 'Infrequent' (10-20%) and 'Rare' (<10%).

Table 1 – Inventory and nature of honey samples (Summer-March to May)

Sample No.	Mandal	Village	Date of collection	Nature of Honey
MCC-27a	Chegunta	Chegunta	08-05-96	Multifloral
MCC-27b	Chegunta	Chegunta	16-04-97	Multifloral
MCV-28a	Chegunta	Valluru	21-05-96	Multifloral
MCV-28b	Chegunta	Valluru	21-05-96	Uni floral-Lannea
MCG-29a	Chegunta	Gundrad up ally	03-05-96	Uni floral-Lannea
MHM-18c	Hathura	Mangapuram	21-04-96	Multifloral
MHM-18d	Hathnura	Mangapuram	21-04-96	Multifloral
MHM-30a	Hathnura	Daulapur	09-03-97	Uni floral-Prosopis
MHM-31a	Hathnura	Daulathabad	09-03-97	Uni floral-Sphaeranthus
MMC-32a	Munipally	Chal apally	04-04-96	Uni floral-Eucalyptus
MMC-32b	Munipally	Chel apally	04-04-96	Uni floral-Sphaeranthus
MMC-32c	Munipally	Chel apally	04-04-96	Uni floral-Eucalyptus
MRR-33a	Ramayapet	Ramayapet	31-03-96	Uni floral-Sphaeranthus
MRA-34a	Ramayampet	Akannapet	31-03-96	Multifloral
MTD-35a	Tupran	Dandupally	38-03-96	Multifloral
MTG-36a	Tupran	Ghanpur	20-03-97	Multifloral
MTeB-37a	Tekmal	Bodmetpalli	22-03-97	Multifloral
MAC-38a	Alladurg	Chinnachakram-pally	29-03-97	Multifloral
MMR-39a	Medak	Rajpally	19-03-97	Uni floral-Prosopis
MJJa-40a	Jagadevpur	Jagadevpur	28-04-97	Multifloral
MJiG-25b	Jinnaram	Gummadiala	25-03-97	Uni floral-Feronia
MPaPa-41a	Papannapet	Papannapet	30-04-97	Multifloral



Map 1. Map showing location of Medak District (shaded) in Andhra Pradesh.

Table 2 – Significant pollen types recorded in Medak District honeys (March - May, 1996 and 1997)

Predominant pollen types (>45%)	Secondary pollen types (16-45%)	Important minor pollen types (3-15%)
<i>Sphaeranthus indicus</i>	<i>Sapindus emarginatus</i>	<i>Terminalia arjuna</i>
<i>Lannea coromandelica</i>	<i>Lannea coromandelica</i>	<i>Opilia amentacea</i>
<i>Prosopis juliflora</i>	<i>Helianthus annuus</i>	<i>Bassia latifolia</i>
<i>Eucalyptus globulus</i>	<i>Phoenix sylvestris</i>	<i>Eucalyptus globulus</i>
<i>Feronia elephantum</i>	<i>Eucalyptus globulus</i>	<i>Ageratum conyzoides</i>
	<i>Terminalia arjuna</i>	<i>Carthamus tinctorius</i>
	<i>Careya arborea</i>	<i>Sphaeranthus indicus</i>
	<i>Psidium guajava</i>	<i>Prosopis juliflora</i>
	<i>Capsicum frutescens</i>	<i>Psidium guajava</i>
	<i>Prosopis juliflora</i>	<i>Lannea coromandelica</i>
	<i>Sphaeranthus indicus</i>	<i>Schleichera oleosa</i>
	<i>Brassica nigra</i>	<i>Careya arborea</i>
	<i>Carum copticum</i>	<i>Helianthus annuus</i>
	<i>Coriandrum sativum</i>	<i>Moringa oleifera</i>
		<i>Capparis zeylanica</i>
		<i>Tridax procumbens</i>
		<i>Phoenix sylvestris</i>
		<i>Cyanotis sp.</i>
		<i>Ricinus communis</i>
		<i>Justicia procumbens</i>
		<i>Ocimum sp.</i>
		<i>Capsicum frutescens</i>
		<i>Euphorbia thymifolia</i>

OBSERVATIONS

Pollen analysis of honey samples

Pollen analysis of summer honeys suggested that out of 22 samples, 10 (45.4%) samples were found to be unifloral and

Table 3 – Pollen recorded only as minor types (<3%)

<i>Abutilon indicum</i>	<i>Hyptis suaveolens</i>
<i>Acacia nilotica</i>	<i>Ipomoea aquatica</i>
<i>Acacia sp.</i>	<i>Lagascea mollis</i>
<i>Ailanthus excelsa</i>	<i>Lagerstroemia parviflora</i>
<i>Alangium salvifolium</i>	<i>Lepidagathis cristata</i>
<i>Albizia lebbek</i>	<i>Launaea pinnatifida</i>
<i>Allium cepa</i>	<i>Leucaena leuccephala</i>
<i>Argemone mexicana</i>	<i>Leucas aspera</i>
<i>Aspidopterys indica</i>	<i>Mangifera indica</i>
<i>Blepharis maderaspatensis</i>	<i>Mollugo pentaphylla</i>
<i>Cajanus cajan</i>	<i>Momordica charantia</i>
<i>Cassia sp.</i>	<i>Ocimum basilicum</i>
<i>Celosia argentea</i>	<i>Parkinsonia aculeata</i>
<i>Chenopodium album</i>	<i>Peltophorum pterocarpum</i>
<i>Chrozophora prostrata</i>	<i>Polygonum glabrum</i>
<i>Citrus limon</i>	<i>Pongamia pinnata</i>
<i>Clemone viscosa</i>	<i>Randia dumetorum</i>
<i>Coccinia indica</i>	<i>Rungia repens</i>
<i>Cocos nucifera</i>	<i>Sesamum indicum</i>
<i>Commelina bengalensis</i>	<i>Sida acuta</i>
<i>Croton bonplandianum</i>	<i>Solanum sp.</i>
<i>Delonix regia</i>	<i>Spinacia oleracea</i>
<i>Dodonaea viscosa</i>	<i>Syzygium cumini</i>
<i>Evolvulus alsinoides</i>	<i>Terminalia bellirica</i>
<i>Guzotia abyssinica</i>	<i>Tinospora cordifolia</i>
	<i>Triumfetta rhomboidea</i>
	<i>Vernonia cinerea</i>

12 (54%), multifloral. Of the 10 unifloral honeys, *Sphaeranthus indicus* (54.5-83.6%) constituted the predominant pollen type in 3(30%) samples, *Lannea coromandelica* (62 & 70.33%), *Prosopis juliflora* (58.28 & 58.8%), and *Eucalyptus globulus* (46.6 & 90.1%) in 2 (20%) samples each and *Feronia elephantum* (59%) in 1 (10%) samples.

Helianthus annuus, *Sapindus emarginatus*, *Lannea coromandelica*, *Phoenix sylvestris*, *Eucalyptus globulus*, *Terminalia arjuna*, *Careya arborea*, *Psidium guajava*, *Capsicum frutescens*, *Prosopis juliflora*, *Sphaeranthus indicus*, *Brassica nigra*, *Carum copticum*, and *Coriandrum sativum* were recorded as secondary pollen types.

Detailed information regarding the Predominant, Secondary and Important minor pollen types recorded in summer honeys of Medak District is given in Table -2. Fifty four pollen types were encountered only as minor types (<3%) in the total contingent of honey samples studied (Table-3).

Photomicrographs of some of the significant and characteristic pollen types (taxa) used by *Apis florea* and recovered from the summer honey of Medak District are illustrated in Plate 1 and 2. In all, 82 pollen types of nectariferous taxa referable to 40 families have been recognised from the 22 summer honey samples studied (see, Table-4).

Of the 22 samples, 15 samples yielded 16-30 pollen types, 4 samples showed 11-15 pollen types and 3 samples showed 6-10 pollen types. Maximum number of pollen types (28) were recorded from the sample MJJa-40a of Jagadevpur locality and the minimum number (6) from MMR-39a sample of Rajpaly village of Medak mandal.



PLATE-1

(All photomicrographs x 1000, except otherwise mentioned)

1. *Croton bonplandianum*. 2. *Brassica nigra*. 3. *Opilia amentacea*. 4,5. *Terminalia arjuna*. 6,7. *Hyptis suaveolens*. 8. *Justicia procumbens*. 9. *Psidium guajava*, 10,11. *Capsicum frutescens*. 12,13. *Lannea coromandelica*. 14,15. *Lagerstroemia parviflora*. 16,17. *Prosopis juliflora*. 18. *Eucalyptus globulus*. 19. *Syzygium cumini*. 20. *Carthamus tinctorius*. 21-24. *Careya arborea*.

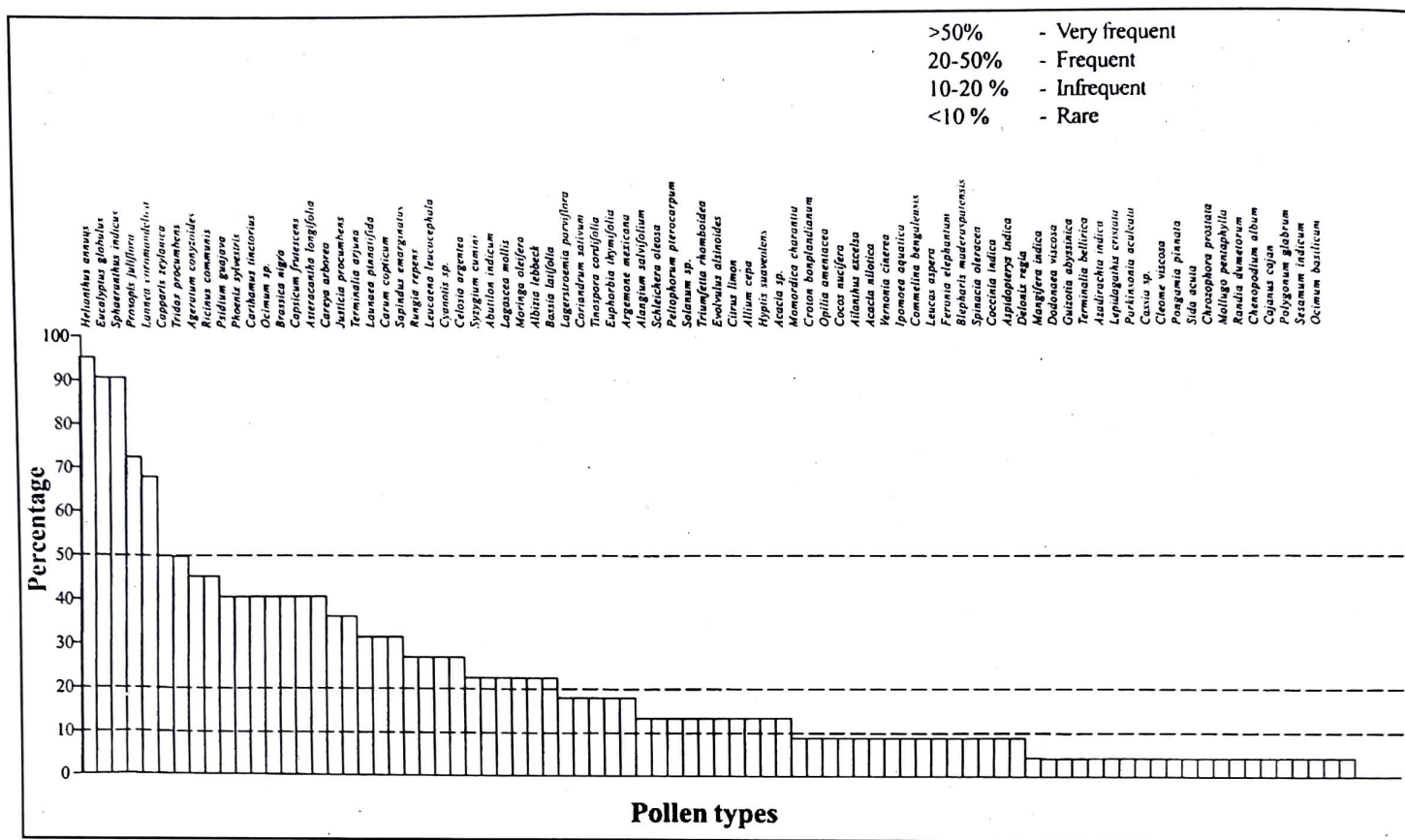


Fig. 1- Frequency of occurrence of pollen types of melliferous taxa encountered in the summer honeys.

The frequency of occurrence of pollen types (Fig. 1) of nectariferous taxa showed 5 pollen types representing in more than 50% of the honey samples and were considered as "Very frequent" types viz., *Helianthus annuus*, *Eucalyptus globulus*, *Sphaeranthus indicus*, *Prosopis juliflora* and *Lannea coromandelica*. 26 pollen types were encountered in 20-50% of the honeys and referred as "Frequent" types, 15 pollen types encountered in 10-20% of the honeys as "Infrequent" types and 36 pollen which occurred in <10% of the honeys as "Rare" types.

A few pollen types of non-nectariferous or anemophilous taxa, viz., grass pollen, *Zea mays*, *Typha angustata*, *Sorghum vulgare*, *Cyperus rotundus* and *Oryza sativa* were encountered in minor percentages (mostly in less than 1%) and represent inadvertent contaminants in the hives.

The moisture content in all the samples is determined with ERMA refractometer and was found to be between 18-22%. The colour of the honey samples ranged from yellow to different shades of amber.

DISCUSSION

The present study is based upon 22 squeezed honey samples of *Apis florea* combs obtained during summer and it involves qualitative and quantitative analysis of pollen contents of honey samples.

Of the 22 honey samples, 10 (45.4%) were found to be unifloral and remaining 12 (54.5%), multifloral. The results

indicate that 5 pollen types, viz., *Sphaeranthus indicus*, *Lannea coromandelica*, *Prosopis juliflora*, *Eucalyptus globulus* and *Feronia elephantum* were recorded as predominant pollen types from 10 unifloral honeys.

Of the 10 unifloral honeys, *Sphaeranthus indicus* formed the predominant pollen type in 3(30%) samples, *Lannea coromandelica*, *Prosopis juliflora* and *Eucalyptus globulus* in 2(20%) samples each and *Feronia elephantum* in one (10%) sample.

The other noteworthy nectar sources of this area include (represented by 10% and more in the pollen spectrum of each sample), *Helianthus annuus*, *Sapindus emarginatus*, *Lannea coromandelica*, *Phoenix sylvestris*, *Eucalyptus globulus*, *Terminalia arjuna*, *Careya arborea*, *Psidium guajava*, *Capsicum frutescens*, *Prosopis juliflora*, *Sphaeranthus indicus*, *Brassica nigra*, *Carum copticum*, *Coriandrum sativum*, *Schleichera oleosa*, *Cyanotis sp.*, *Ricinus communis*, *Ocimum sp.*, and *Opilia amentacea*. In the total contingent of honey samples, the top families which provided nectar for *Apis florea* bees as evidenced by the species visited by them are Myrtaceae (23.80%), Asteraceae (18.50%), Anacardiaceae (14%), Mimosaceae (12.40%), Umbelliferae (4.2%) and Sapindaceae (3.7%) (Fig. 2).

The importance of a taxon as a regional or geographical indicator depends on the frequency of the occurrence of its pollen in the total contingent of honey samples (Ramanujam, 1991; Kalpana & Ramanujam 1998). *Eucalyptus globulus*,

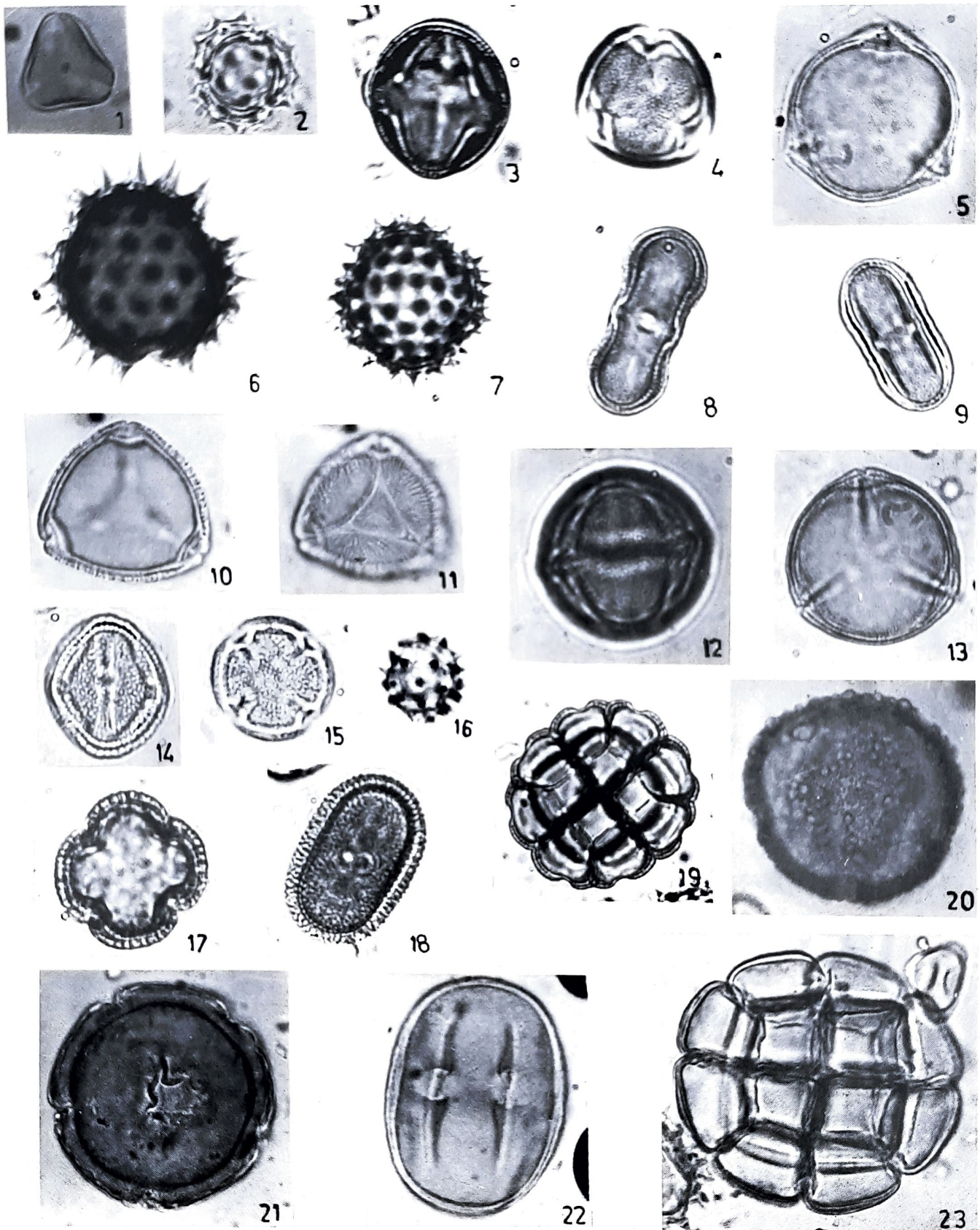


PLATE-2

(All photomicrographs x 1000, except otherwise mentioned)

1. *Sapindus emarginatus*. 2. *Ageratum conyzoides*. 3,4. *Mangifera indica*. 5. *Dodonaea viscosa*. 6. *Helianthus annuus*. 7. *Tridax procumbens*. 8. *Coriandrum sativum*. 9. *Carum copticum*. 10,11. *Schleichera oleosa*. 12,13. *Ricinus communis*. 14,15. *Feronia elephantum*. 16. *Sphaeranthus indicus*. 17. *Citrus limon*. 18. *Rungia repens*. 19. *Acacia nilotica* (x750). 20. *Alangium salvifolium* (x 500). 21,22. *Bassia latifolia* (x750). 23. *Albizia lebbek* (x500).

Table 4 – Representation of various families in summer honeys of Medak District

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>Lannea coromandelica</i> , <i>Mangifera indica</i>
Arecaceae	<i>Phoenix sylvesteris</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>Guizotia abyssinica</i> , <i>Launaea pinnatifida</i> , <i>Vernonia cinerea</i> , <i>Lagascea mollis</i>
Barringtoniaceae	<i>Careya arborea</i>
Caesalpiniaceae	<i>Peltophorum pterocarpum</i> , <i>Cassia</i> sp., <i>Delonix regia</i> , <i>Parkinsonia aculeata</i>
Capparidaceae	<i>Capparis zeylanica</i> , <i>Cleome viscosa</i>
Chenopodiaceae	<i>Chenopodium album</i> , <i>Spinacea oleracea</i>
Combretaceae	<i>Terminalia arjuna</i> , <i>Terminalia belirica</i>
Commelinaceae	<i>Cyanotis</i> sp., <i>Commelina bengalensis</i>
Convolvulaceae	<i>Evolvulus alsinoides</i> , <i>Ipomoea aquatica</i>
Cruciferae	<i>Brassica nigra</i>
Cucurbitaceae	<i>Momordica charantia</i> , <i>Coccinia indica</i>
Euphorbiaceae	<i>Ricinus communis</i> , <i>Euphorbia thynifolia</i> , <i>Chrozophora prostrata</i> , <i>Croton bonplandianum</i>
Lamiaceae	<i>Ocimum basilicum</i> , <i>Ocimum</i> sp., <i>Hyptis suaveolens</i> , <i>Leucas aspera</i>
Liliaceae	<i>Allium cepa</i>
Lythraceae	<i>Lagerstroemia parviflora</i>
Malvaceae	<i>Abutilon indicum</i> , <i>Sida acuta</i>
Malpigiaceae	<i>Aspidopterys indica</i>
Meliaceae	<i>Azadirachta indica</i>
Menispermaceae	<i>Tinospora cordifolia</i>
Mimosoideae	<i>Leucaena leucocephala</i> , <i>Prosopis juliflora</i> , <i>Acacia nilotica</i> , <i>Acacia</i> sp., <i>Albizia lebbek</i>
Molluginaceae	<i>Mollugo pentaphylla</i>
Moringaceae	<i>Moringa oleifera</i>
Myrtaceae	<i>Eucalyptus globulus</i> , <i>Syzygium cumini</i> , <i>Psidium guajava</i>
Opiliaceae	<i>Opilia amentacea</i>
Papa varaceae	<i>Argemone mexicana</i>
Papilionaceae	<i>Cajanus cajan</i> , <i>Pongamia pinnata</i>
Pedaliaceae	<i>Sesamum indicum</i>
Polygonaceae	<i>Polygonum glabrum</i>
Rubiaceae	<i>Randia dumetorum</i>
Rutaceae	<i>Citrus limon</i> , <i>Feronia elephantum</i>
Sapindaceae	<i>Sapindus emarginatus</i> , <i>Schleichera oleosa</i> , <i>Dodonaea viscosa</i>
Sapotaceae	<i>Bassia latifolia</i>
Simaroubaceae	<i>Ailanthus excelsa</i>
Solanaceae	<i>Capsicum frutescens</i> , <i>Solanum</i> sp.
Umbelliferae	<i>Carum copticum</i> , <i>Coriandrum sativum</i>
Tiliaceae	<i>Triumfetta rhomboidea</i>

Helianthus annuus, *Prosopis juliflora*, *Sphaeranthus indicus*, and *Lannea coromandelica* complex, the pollen of which were encountered in >60% of the honeys studied and represent regional indicators of honeys from Medak District.

Arborescent taxa like *Lannea coromandelica*, *Terminalia arjuna*, *Sapindus emarginatus*, *Bassia latifolia*, *Eucalyptus globulus*, *Phoenix sylvestris*, *Careya arborea*, *Schleichera*

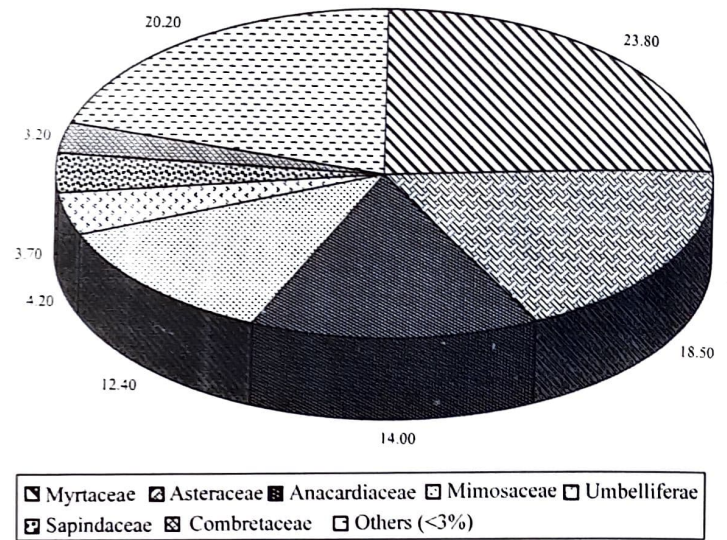


Fig. 2- Composite spectrum of frequencies of families (>3%) in the summer honey samples

oleosa, *Prosopis juliflora*, *Feronia elephantum*, and *Psidium guajava*, which are in full bloom during summer contributed fairly to the honey production of this area.

All such taxa representing as predominant pollen types in the unifloral honeys were considered as chief sources of nectar and those represented by at least 10% in the pollen spectrum of each honey sample, as medium sources of nectar.

Our study suggests that the information regarding the bee forage can profitably be utilised during the afforestation or social forestry programmes facilitating enhanced honey production and may also encourage commercial bee-keeping ventures in Medak District.

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