

Pollen diversity in *Apis* honeys of Narsipatnam Forest, Visakhapatnam District, Andhra Pradesh, India

R. Devender¹, H. Ramakrishna^{1*} and S. B. Padal²

¹Department of Botany, University College of Science, Saifabad, Osmania University, Hyderabad-500004, India

²Department of Botany, Andhra University, Visakhapatnam-530003, India
E-mail: devender.bot@gmail.com; hrkpaleobot@gmail.com; sbpadal08@gmail.com

*Corresponding author

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ABSTRACT

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The paper incorporates pollen analysis of five squeezed *Apis florea* honey samples collected from Narsipatnam Forest Division of Visakhapatnam District, Andhra Pradesh during 2011-2012. Of these, two honey samples are unifloral and remaining three are multifloral. *Schleichera oleosa* pollen are predominant in unifloral honey samples. The other significant pollen types are of *Mimosa pudica*, *Syzygium* sp., *Eucalyptus globulus*, *Tridax procumbens*, *Terminalia arjuna* and *Corchorus fascicularis*. These pollen types are therefore fairly reliable nectar source for honey bees in this area.

Key-words: Melissopalynology, pollen diversity, *Apis* honey, Narsipatnam Forest, Visakhapatnam District, Andhra Pradesh, India.

INTRODUCTION

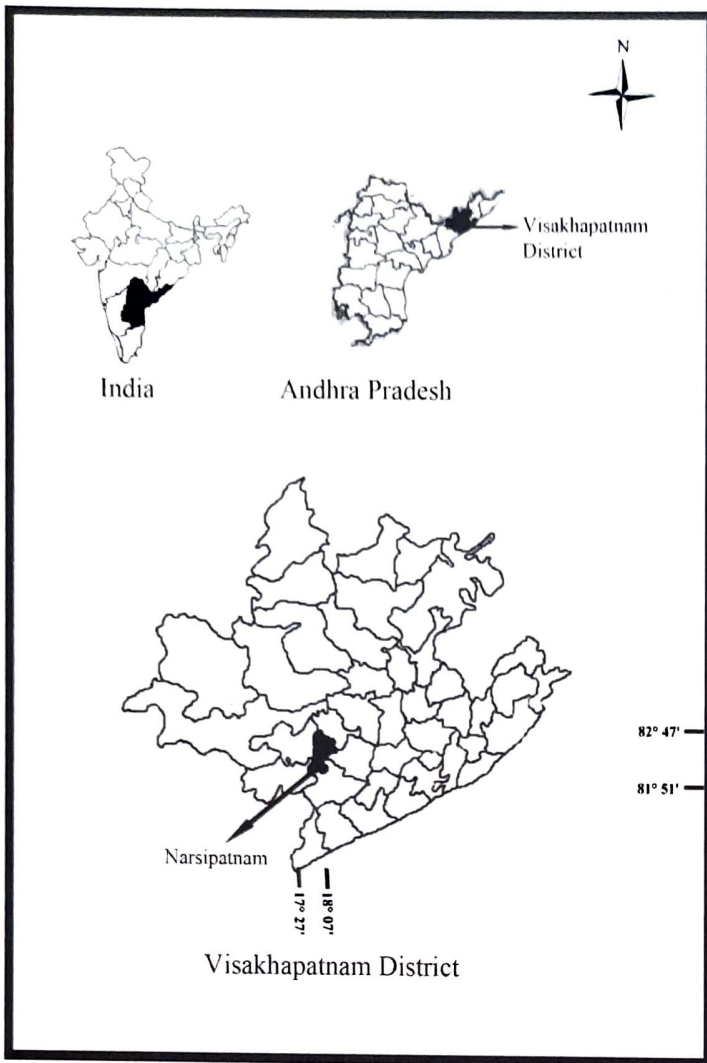
Narsipatnam Forest Division lies in the north-eastern part of Andhra Pradesh (Latitudes 17°27'33" to 18°07'02"N, Longitudes 81°51'47" to 82°47'59"E). This forest division covers an area of 3754.99 km², which is 30.95% of the area of Visakhapatnam District. The pollen characterization and quantification of honeys constitute a fairly reliable auxiliary method for recognizing the nectar source and botanical origin of honey. The study further indicates that the rich floral resources of this district may enhance the bee-keeping industry and honey production.

MATERIAL AND METHOD

Five squeezed *Apis florea* honey samples (200

ml each) were collected from Narsipatnam Forest of Visakhapatnam District, Andhra Pradesh (Text-figure 1). These were processed for pollen recovery by using Erdtman's (1960) acetolysis technique. Three slides were prepared from each sample for study and identification of pollen types. The pollen types were identified up to genus or species level with the help of prepared reference pollen slides of local flora and relevant literature.

For determining percentage of pollen types, 300 pollen specimens per sample were counted. Honeys with a predominant pollen type (>45%) were termed as unifloral and the rest as multifloral. As per Louveaux et al. (1978), four frequency classes are recognized, viz. i. predominant (P = >45%); ii. secondary (S = 16-45%); iii. important



Text-figure 1. Map showing the study area.

minor (I = 3-15%); and iv. minor (M = <3%). The pollen spectra for each honey sample were prepared on the basis of frequencies of the pollen types (Text-figures 2-6).

OBSERVATION

Altogether, five honey samples were palynologically analyzed. Of these, two honey samples are unifloral and three are multifloral. Forty-three pollen types, referable to 23 families, were recorded in these honeys. Most of the pollen types are common to all the honey samples, indicating their same geographical origin. The frequency class-wise representation of pollen types in each sample is given below.

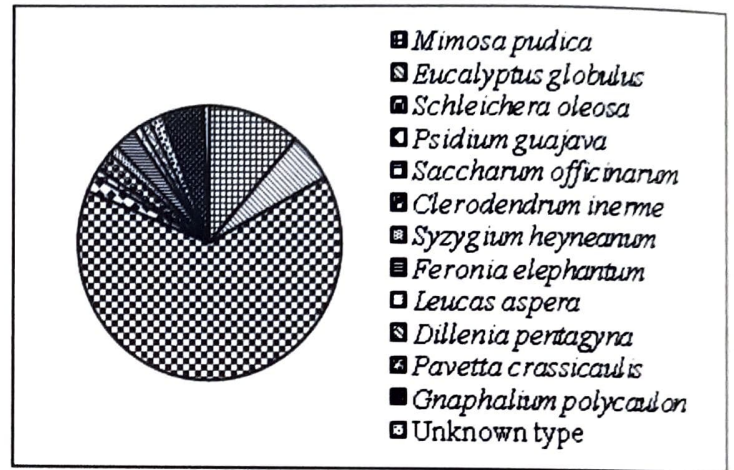
1. Sample no. V-N-AF-12, unifloral (Text-figure 2).

P: *Schleichera oleosa* (64.2%).

S: Nil.

I: *Mimosa pudica* (11.3%), *Eucalyptus globulus* (5.7%), *Gnaphalium polycaulon* (5.7%).

M: *Clerodendrum inerme* (2.2%), *Feronia elephantum* (2.7%), *Psidium guajava* (1.2%), *Saccharum officinarum* (1.0%), *Syzygium heyneanum* (1.2%), *Leucas aspera* (1.0%), *Dillenia pentagyna* (1.2%), *Pavetta crassicaulis* (1.7%) and Unknown type (0.9%).



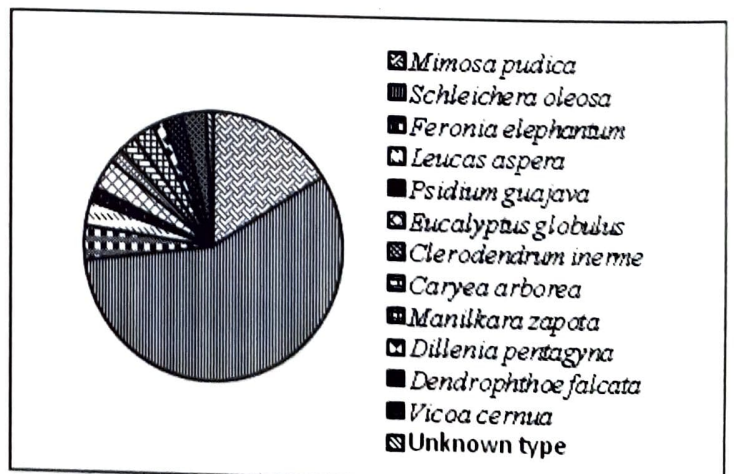
Text-figure 2. Pie diagram showing pollen representation in honey sample no. V-N-AF-12.

2. Sample no. V-N-AF-13, unifloral (Text-figure 3).

P: *Schleichera oleosa* (60.8%).

S: Nil.

I: *Mimosa pudica* (14.6%), *Feronia elephantum* (3.3%) and *Eucalyptus globulus* (3.3%).



Text-figure 3. Pie diagram showing pollen representation in honey sample no. V-N-AF-13.

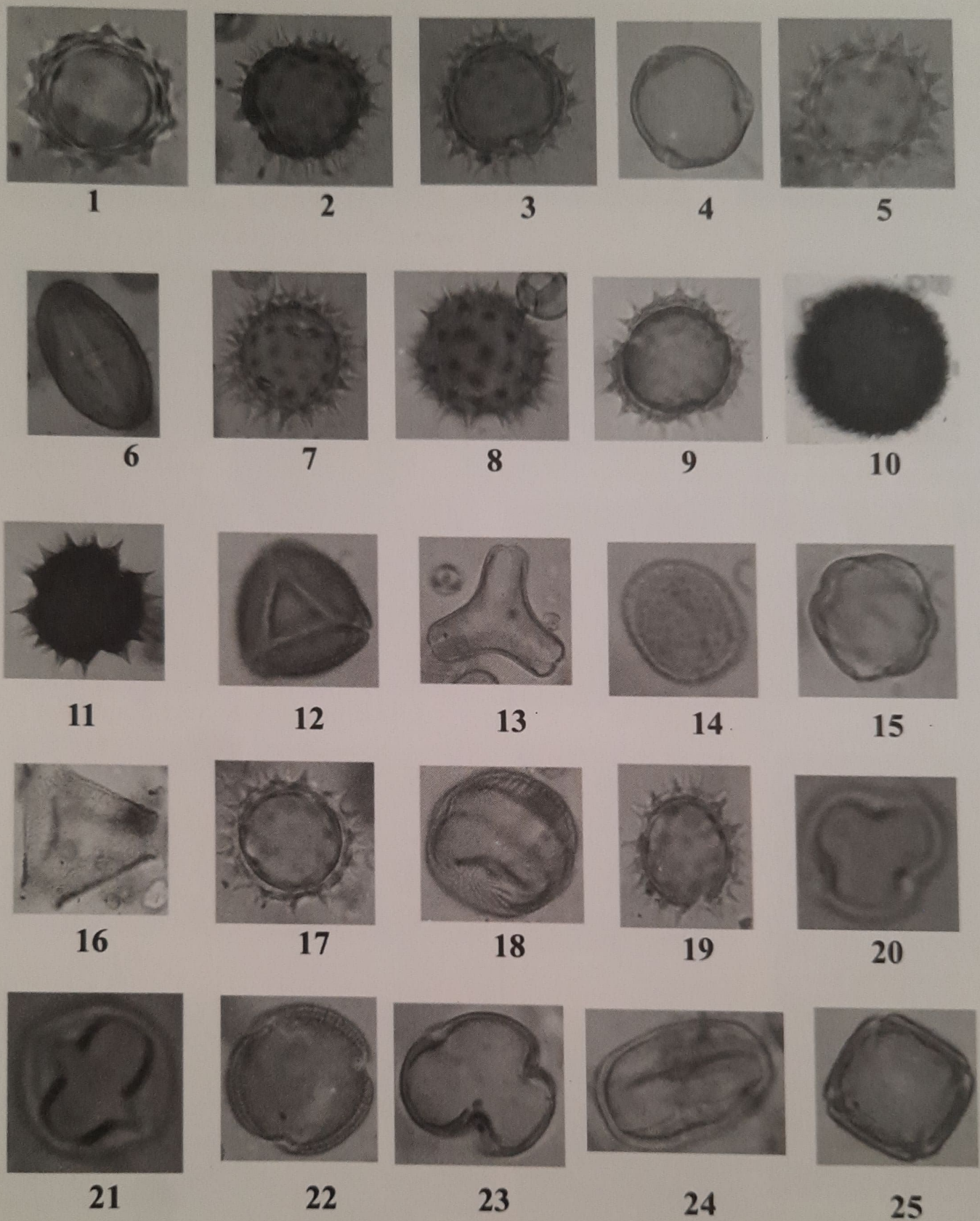


Plate 1

All figures magnified x1000, except stated otherwise

1. *Ageratum conyzoides*, x1200. 2. *Centipeda minima*. 3. *Conyza stricta*. 4. *Corchorus fascicularis*. 5. *Pulicarrhia foliolosa*. 6. *Blepharis maderaspatensis*. 7. *Tridax procumbens*. 8. *Guizotia abyssinica*. 9. *Gnaphalium polycaulon*. 10. *Sida cordata*. 11. *Sphaeranthus indicus*. 12. *Schliechera oleosa*. 13. *Dendrophthoe falcate*. 14. *Commilina suffruticosa*. 15. *Terminalia arjuna*. 16. *Erythrina indica*. 17. *Vicoa cernua*. 18. *Bauhinia purpurea*. 19. *Cyathocline purpurea*. 20. *Crotalaria juncea*. (polar view), x2800. 21. *Crotalaria juncea* (equatorial view), x2800. 22. *Celasrtus paniculatus*. 23. *Cassia mimosoides* (polar view). 24. *Cassia mimosoides* (equatorial view). 25. *Lantana camera*.

M: *Leucas aspera* (2.7%), *Caryea arborea* (1.1%), *Manilkara zapota* (2.4%), *Dendrophthoe falcata* (2.7%), *Vicoacernua* (2.9%), *Clerodendrum inerme* (1.5%), *Psidium guajava* (1.5%), *Dillenia pentagyna* (2.0%) and Unknown type (1.2%).

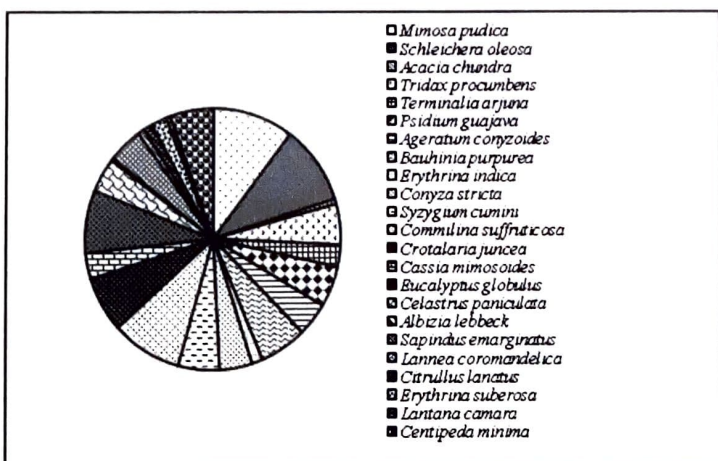
3. Sample no. V-N-AF-14, unifloral (Text-figure 4).

P: Nil.

S: Nil.

I: *Mimosa pudica* (6.7%), *Schleichera oleosa* (6.2%), *Tridax procumbens* (5.5%), *Psidium guajava* (5.6%), *Syzygium cumini* (7.6%), *Commilina suffruticosa* (5.6%), *Crotalaria juncea* (4.1%), *Eucalyptus globulus* (10.0%), *Ageratum conyzoides* (6.9%), *Centipeda minima* (15.0%) and *Erythrina suberosa* (3.0%).

M: *Conyza stricta* (2.6%), *Cassia mimosoides* (2.6%), *Celastrus paniculata* (2.1%), *Sapindus emarginatus* (1.5%), *Terminalia arjuna* (2.2%), *Lannea coromandelica* (1.5%), *Citrullus lanatus* (2.1%), *Erythrina indica* (2.1%), *Acacia chundra* (2.2%), *Albizia lebbeck* (1.7%), *Bauhinia purpurea* (2.2%) and *Lantana camara* (1.0%).



Text-figure 4. Pie diagram showing pollen representation in honey sample no. V-N-AF-14.

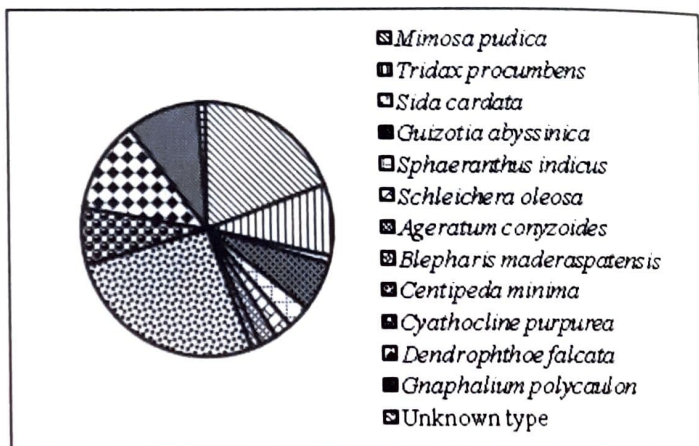
4. Sample no. V-N-AF-22, unifloral (Text-figure 5).

P: Nil.

S: *Mimosa pudica* (33.7%) and *Tridax procumbens* (27.6%).

I: *Gnaphalium polycaulon* (7.6%), *Dendrophthoe falcata* (3.3%), *Cyathocline purpurea* (4.7%), *Guizotia abyssinica* (5.6%), *Ageratum conyzoides* (4.7%).

M: *Sida cordata* (2.6%), *Blepharis maderaspatensis* (1.1%), *Centipeda minima* (2.9%), *Sphaeranthus indicus* (2.6%), *Schleichera oleosa* (2.0%) and Unknown type (1.6%).

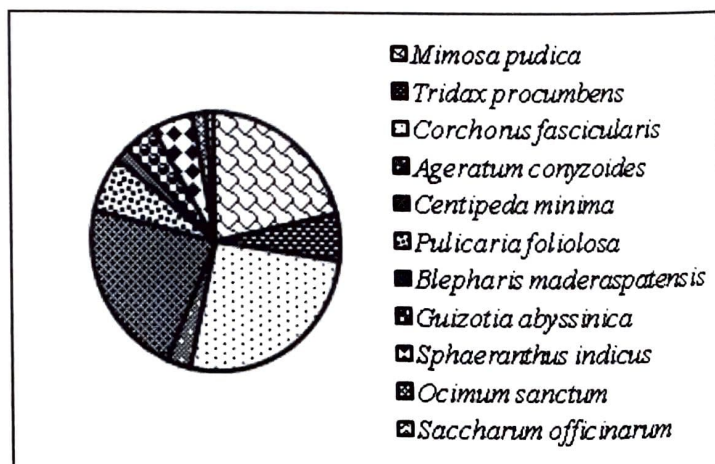


Text-figure 5. Pie diagram showing pollen representation in honey sample no. V-N-AF-22.

5. Sample no. V-N-AF-23, unifloral (Text-figure 6).

P: Nil.

S: *Mimosa pudica* (28.2%), *Corchorus fascicularis* (28.5%) and *Tridax procumbens* (25.0%). **I:** *Pulicaria foliolosa* (4.5%), *Guizotia abyssinica* (3.1%) and *Sphaeranthus indicus* (3.8%).



Text-figure 6. Pie diagram showing pollen representation in honey sample no. V-N-AF-23.

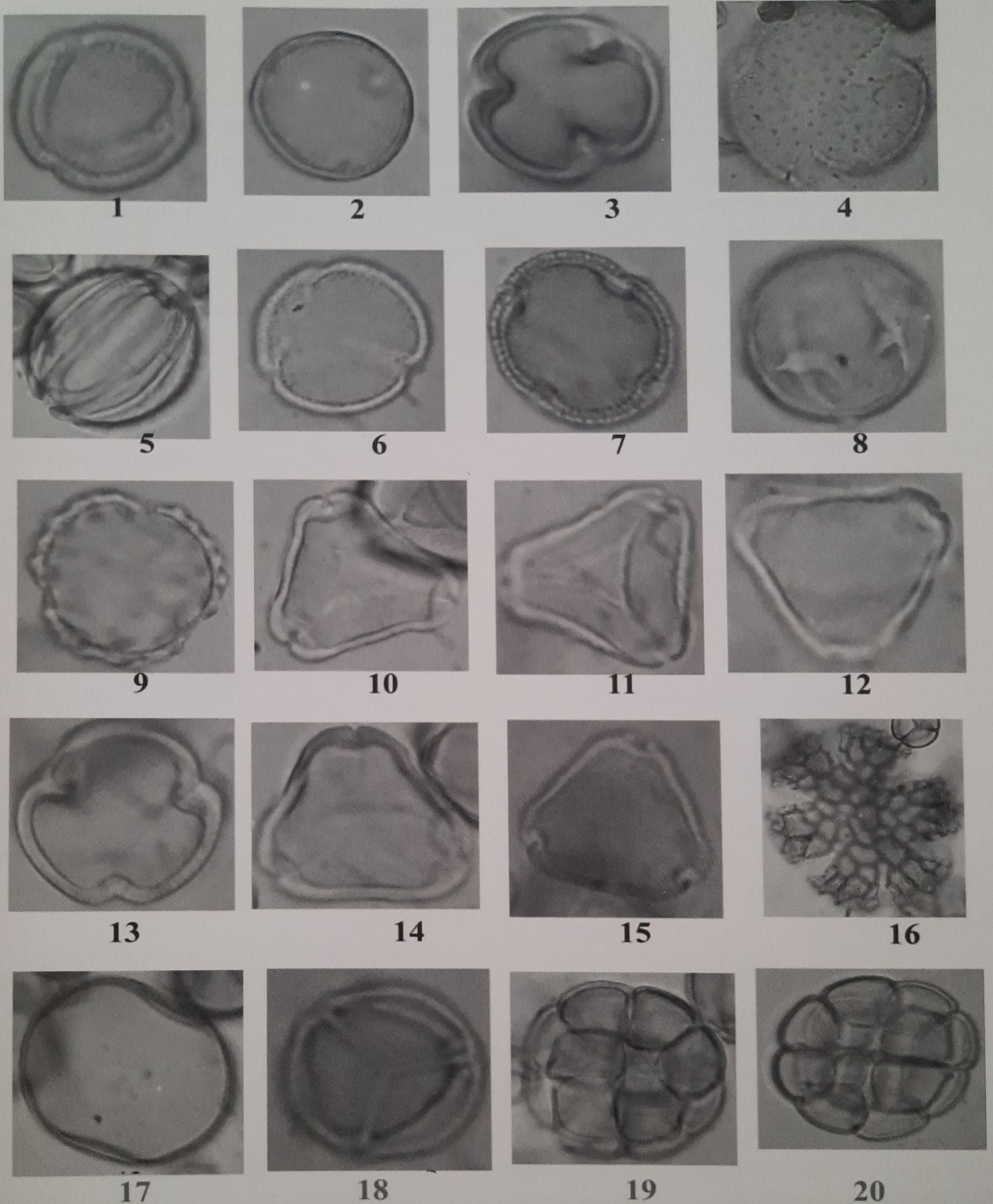


Plate 2

All figures magnified x1000, except stated otherwise

1. *Citrullus lanatus*. 2. *Erythrina suberosa*. 3. *Lanea coromandelica*. 4. *Clerodendrum inerme*. 5. *Caryea arborea*. 6. *Leucus aspera*. 7. *Feronia elephantum*. 8. *Manilkara zapota*. 9. *Dillenia pentagyna*. 10. *Eucalyptus globulus*. 11. *Syzygium cumini*. 12. *Psidium guajava*. 13. *Pavveta crassicularis*. 14. *Syzygium heyneanum*. 15. *Sapindus emarginatus*. 16. *Ocimum sanctum*. 17. *Saccharum officinarum*. 18. *Mimosa pudica*, x3000. 19. *Acacia chundra*. 20. *Albizia lebbeck*.

Table 1. Family-wise pollen diversity in honey samples.

Families	Palynotaxa
Asteraceae	<i>Ageratum conyzoides</i> , <i>Centipeda minima</i> , <i>Conyza strica</i> , <i>Pulicaria foliolosa</i> , <i>Tridax procumbens</i> , <i>Guizotia abyssinica</i> , <i>Gnaphalium polycaulon</i> , <i>Sphaeranthus indicus</i> , <i>Vicoa cernua</i> , <i>Cyathocline purpurea</i>
Tiliaceae	<i>Corchorus fascicularis</i>
Acanthaceae	<i>Blepharis maderaspatensis</i>
Fabaceae	<i>Erythrina indica</i> , <i>E. suberosa</i> , <i>Bauhinia purpurea</i> , <i>Crotalaria juncea</i> , <i>Acacia chundra</i> , <i>Albizia lebeck</i> .
Malvaceae	<i>Sida cordata</i> ,
Sapindaceae	<i>Schliechera oleosa</i> , <i>Sapindus emarginatus</i>
Loranthaceae	<i>Dendrophthoe falcate</i>
Commelinaceae	<i>Commilina suffruticosa</i>
Combretaceae	<i>Terminalia arjuna</i>
Celastraceae	<i>Celasrtus paniculatus</i>
Caesalpiniaceae	<i>Cassia mimosoides</i>
Cucurbitaceae	<i>Citrullus lanatus</i>
Anacardiaceae	<i>Lannea coromandelica</i>
Verbenaceae	<i>Clerodendrum inerme</i> , <i>Lantana camera</i>
Lecythidaceae	<i>Caryea arborea</i>
Lamiaceae	<i>Leucus aspera</i> , <i>Ocimum sanctum</i>
Rutaceae	<i>Feronia elephantum</i>
Sapotaceae	<i>Manilkara zapota</i>
Dilleniaceae	<i>Dillenia pentagyna</i>
Myrtaceae	<i>Eucalyptus globulus</i> , <i>Syzygium cumini</i> , , <i>S. heyneanum</i> , <i>Psidium guajava</i>
Rubiaceae	<i>Pavveta crassicularis</i>
Mimosaceae	<i>Mimosa pudica</i>
Poaceae	<i>Saccharum officinarum</i>

M: *Centipeda minima* (2.0%), *Ageratum conyzoides* (1.6%), *Blepharis maderaspatensis* (0.9%), *Ocimum sanctum* (1.7%) and *Saccharum officinarum* (0.7%).

DISCUSSION

Pollen taxa, represented in the honey samples of Narsipatnam Forest Division, belong to following 23 families: Asteraceae, Tiliaceae, Acanthaceae, Fabaceae, Malvaceae, Sapindaceae, Loranthaceae, Commelinaceae, Combretaceae, Celastraceae, Caesalpiniaceae, Cucurbitaceae, Anacardiaceae, Verbenaceae, Lecythidaceae, Lamiaceae, Rutaceae, Sapotaceae, Dilleniaceae, Myrtaceae, Rubiaceae, Mimosaceae and Poaceae (Table 1, Plates 1, 2).

Tridax procumbens, *Ageratum conyzoides*

and *Sphaeranthus indicus*, recorded in the present study, were recorded as predominant pollen types from the *A. florea* honey samples of Ranga Reddy District, Andhra Pradesh (Ramanujam & Kalpana 1990). *Tridax procumbens*, *Ageratum conyzoides*, *Ocimum basilicum*, *Vernonia cinerea*, *Celosia argentea*, *Brassica nigra*, *Cajanus cajan*, *Ricinus communis* and *Sonchus oleraceus* were dominant palynotaxa in *Apis florea* honeys from Adilabad District (Ramakrishna & Swathi 2013). *Lannea coromandalica*, *Terminalia arjuna*, *Madhuca indica*, *Lagestroemia parviflora*, *Sphaeranthus indicus* and *Opilia amentacea* were encountered in *Apis dorsata* honeys from Nizamabad District, Andhra Pradesh (Ramakrishna & Bushan 2004). *Saccharum officinarum*, *Sphaeranthus indicus*, *Eucalyptus globulus* and *Terminalia* sp. are the common pollen taxa recorded in the honey samples of both Adilabad District and of the present study (Swathi & Ramakrishna 2012). *Mimosa pudica*, *Tridax procumbens*, *Ageratum conyzoides* and *Eucalyptus globulus* pollen are common pollen types recorded from the honeys of present locality and Guntur District (Ramanujam & Khatija 1990). In the present work, *Schliechera oleosa* is the predominant pollen type which was not recorded earlier as predominant from any other locality of Andhra Pradesh. Family Asteraceae is the major source of nectar for honey bees which is followed by Fabaceae and Myrtaceae in the Narsipatnam Forest area.

This pollen diversity in *Apis* honeys, i.e. diversity of bee forage plants, clearly indicates that Narsipatnam Forest Division of Visakhapatnam District, Andhra Pradesh, is a prone area for bee-keeping ventures and useful to enhance honey production from this area.

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