ISSN 0376-5561
Geophytology 45(2): 221-226
November 2015

# Palynodiversity in *Trigona* honeys from Paderu Forest Division of Visakhapatnam district, Andhra Pradesh, India

**R. Devender and H. Ramakrishna***

Department of Botany, University College of Science, Osmania University,
Hyderabad-500007, India
E-mail: devender.bot@gmail.com; hrkpalebot@gmail.com*
*Corresponding author

Manuscript received: 30 September 2015
Accepted for publication: 05 October 2015

## ABSTRACT

Devender R. & Ramakrishna H. 2015. Palynodiversity in *Trigona* honeys from Paderu Forest Division of Visakhapatnam district, Andhra Pradesh, India. Geophytology 45(2): 221-226.

Melissopalynological study of seventeen *Trigona* honey samples, collected from Paderu Forest Division in Visakhapatnam district, Andhra Pradesh provides data regarding forage plants for *Trigona* honey bees during summer and winter seasons of 2013. Based on palynological analysis, five samples are identified as unifloral with predominant pollen types, viz. *Psidium guajava* (81%), *Corchorus fascicularis* (49%), *Ageratum conyzoides* (57%), *Trichilia connaroides* (86%) and *Guazuma ulmifolia* (50%) and the remaining twelve samples as multifloral. Altogether, seventy-two pollen types, referable to forty families, were identified. Of these, 7 species belong to Asteraceae, 5 species to Malvaceae and 4 species to Mimosaceae.

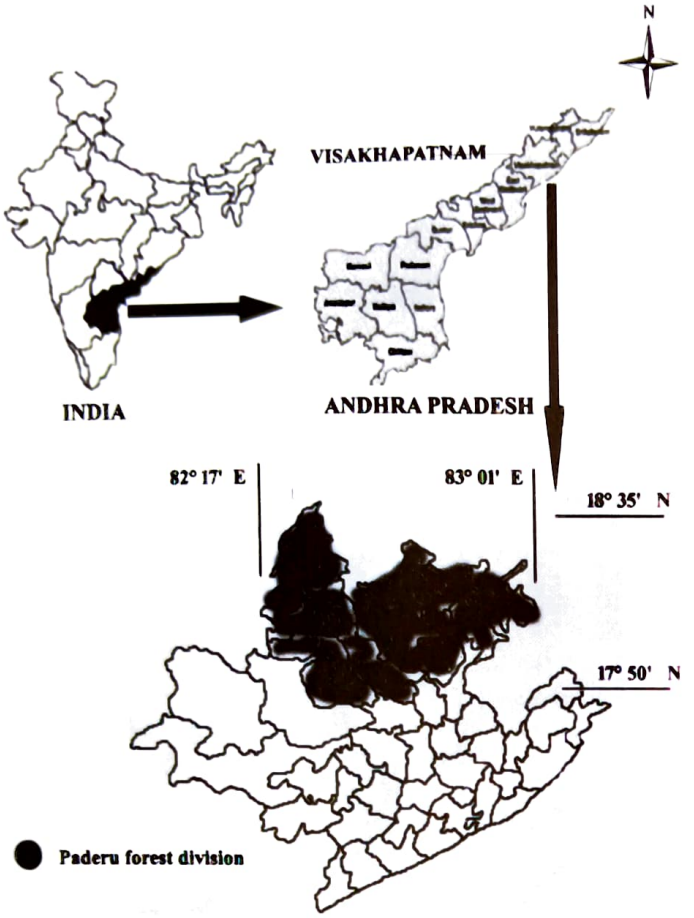
**Key-words:** Palynodiversity, *Trigona* honey, Paderu Forest, Visakhapatnam district, Andhra Pradesh, India.

## INTRODUCTION

*Trigona* is the smallest of the honey producing bees found in India. These stingless bees are highly social and have cells of irregular size and shape in their hives. Each colony is inhabited by several thousand bees which include the queen mother, some virgin queens, a few hundred drones and many worker bees. In India, melissopalynological analysis of *Trigona* honeys and *Apis* honeys have been carried out by Harugade & Chaphalkar (2013), Suresh Kumar (2012) and Devender et al. (2014). The present study is aimed to recognise the nectar source plants for *Trigona* bees from Paderu Forest Division.

## MATERIAL AND METHODS

Seventeen *Trigona* honey samples were collected from various places in Paderu Forest Division of Visakhapatnam district, Andhra Pradesh (Latitudes 17°51'N to 18°35'N; Longitudes 82°17'E to 83°01'E; Text-figure 1). These samples were collected during summer and winter seasons (Table 1) and were processed by using Erdtman's acetolysis technique (1960) to recover the pollen. Three slides were prepared for each sample. Pollen types were identified with the help of reference pollen slides 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




**Text-figure 1.** Study area.

**Table 1. Inventory of *Trigona* honeys from Paderu Forest Division.**

| Sample code | Mandal/ Village | Date of collection |
|---|---|---|
| V-P-Mu-La-tri-39 | Munchingiputtu/ Laxmipuram | 15.04.2013 |
| V-P-Ped-Ped-tri-42 | Peddabayalu/ Peddabayalu | 19.04.2013 |
| V-P-G-Va-tri-43 | G. Madugula/ Vanthala | 20.04.2013 |
| V-P-H-So-tri-46 | Hukumpeta/ Sobakota | 25.04.2013 |
| V-P-A-Be-tri-58 | Ananthagiri/ Beesupuram | 09.11.2013 |
| V-P-H-San-tri-68 | Hukumpeta/ Santhari | 21.12.2013 |
| V-P-Ar-Du-tri-71 | Araku/ Dumbriguda | 22-12-2013 |
| V-P-Ar-Be-tri-72 | Araku/ Beesupuram | 22-12-2013 |
| V-P-G-Kk-tri-74 | G. Madugula/ Kokirapalli | 11-03-2013 |
| V-P-G-Ge-tri75 | G. Madugula/ Gemme | 12-03-2013 |
| V-P-G-Ro-tri-76 | G. Madugula/ Rolangiputtu | 07.04.2013 |
| V-P-G-Sad-tri-77 | G. Madugula/ Sadeku | 12.04.2013 |
| V-P-G-Ko-tri-78 | G. Madugula/ Korakapalli | 18.04.2013 |
| V-P-G-Bo-tri-79 | G. Madugula/ Boddagondi | 18.04.2013 |
| V-P-G-Kp-tri-80 | G. Madugula/ Kothapalli | 24.04.2013 |
| V-P-G-Ra-tri-81 | G. Madugula/ Rachapalli | 24.04.2013 |
| V-P-G-Km-tri-82 | G. Madugula/ Kommalamamidi | 26.04.2013 |

pollen type-I (3-15%) and minor pollen type-M (> 3%) based on their frequencies (Louveaux et al. 1978).

## POLLEN ANALYSIS

All the honey samples were palynologically scanned and seventy-two pollen types were recorded (Plate 1-2). These are referable to forty families (Table 2). The sample-wise pollen analysis of honey samples is given below.

**V-P-Mu-La-tri-39:** P: *Psidium guajava* (81%); S: Nil; I: *Gymnema syvestris* (6%), *Pulicaria foliosa* (7%), *Borassus flabellifer* (6%); M: Nil

**V-P-Ped-Ped-tri-42:** P: Nil; S: *Brassica juncea* (39%), *Terminalia arjuna* (23%); I: *Syzygium cumini* (15%), *Stercularia urens* (11%), *Tridax procumbens* (12%); M: Nil

**V-P-G-Va-tri-43:** P: Nil; S: *Dillenia pentagyna* (32%), *Schleichera oleosa* (24%), *Syzygium cumini* (21%), *Lagerstroemia parviflora* (19%); I: Nil: M: *Terminalia arjuna* (4%)

**V-P-H-So-tri-46:** P: Nil; S: *Ageratum conyzoides* (40%), *Croton bonplandianus* (29%); I: *Annona squamosa* (13%), *Ailanthus excelsa* (10%), *Evolvulus alsinoides* (8%); M: Nil

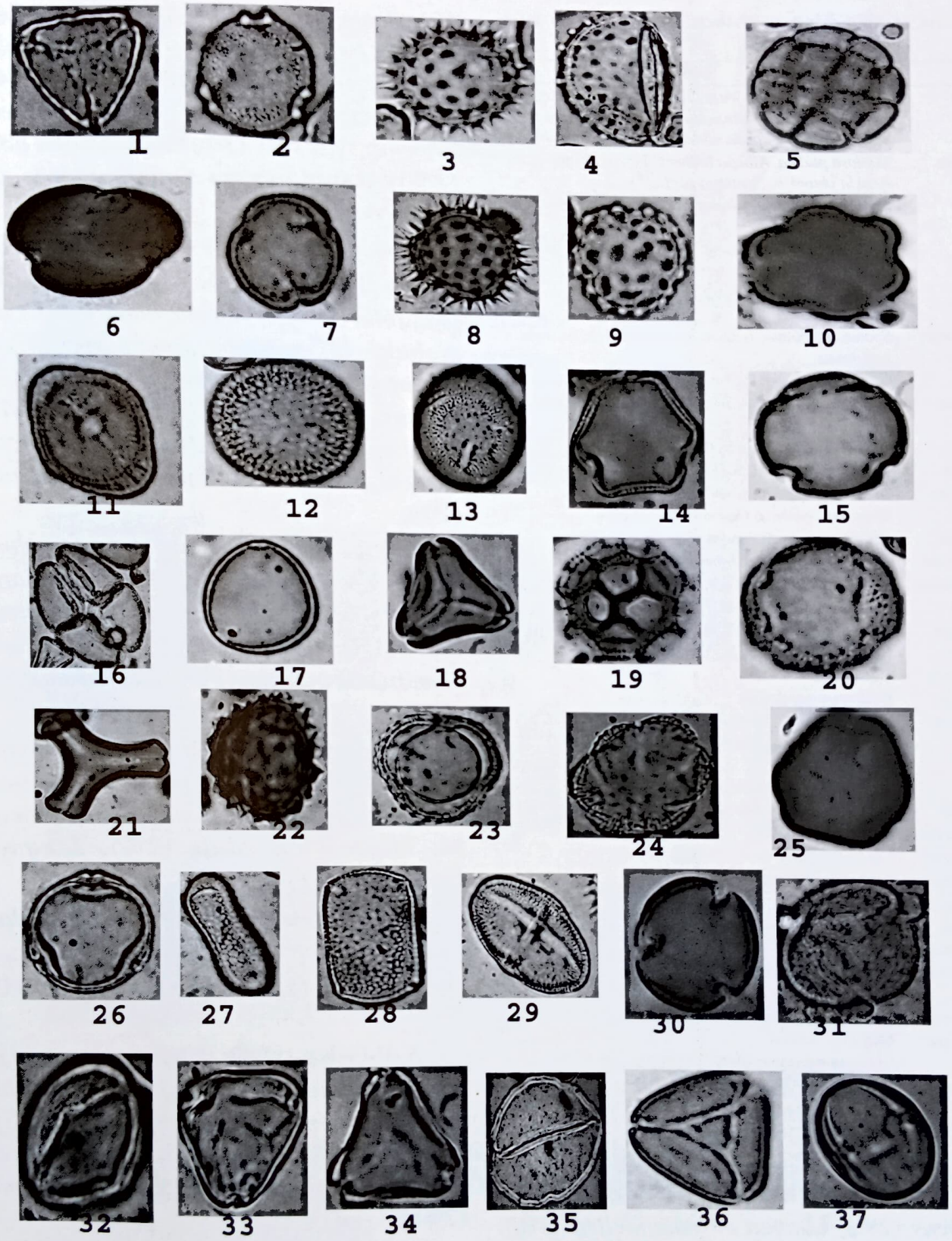
**V-P-A-Be-tri-58:** P: Nil; S: *Eucalyptus globulus* (39%), *Mimosa pudica* (25%), Urticaceae type (19%); I: *Tridax procumbens* (7%), *Vernonia cinerea* (5%), *Centipeda minima* (3%); M: *Dendrophthoe falcata* (2%)

**V-P-H-San-tri-68:** P: Nil; S: *Corchorus fascicularis* (35%); I: *Hyptis suaveolens* (10%), *Xanthium strumarium* (9%), *Rungia repens* (9%), *Impatiens balsamina* (8%), *Blepharis maderaspatensis* (4%), *Dendrophthoe falcata* (7%), *Ageratum conyzoides* (9%), *Mimosa pudica* (9%); M: Nil

**V-P-Ar-Du-tri-71:** P: *Corchorus fascicularis* (49%); S: *Mimosa pudica* (32%); I: *Impatiens balsamina* (5%), *Tridax procumbens* (6%), *Blepharis maderaspatensis* (4%), *Hyptis suaveolens* (4%); M: Nil

**V-P-Ar-Be-tri-72:** P: Nil; S: *Schleichera oleosa* (26%), *Eucalyptus globulus* (22%), *Lannea coromandelica* (17%); I: Urticaceae type (11%), *Sapindus laurifolius* (11%), *Cocos nucifera* (4%), *Ageratum conyzoides* (4%), *Solanum trilobatum* (5%); M: Nil

**V-P-G-Kk-tri-74:** P: Nil; S: *Schleichera oleosa* (28%), *Corchorus fascicularis* (27%), *Spondias*




## Plate 1

All figures ×500

1. *Psidium guajava*, 2. *Gymnema sylvestris*, 3. *Pulicaria foliosa*, 4. *Borassus flabellifera*, 5. *Acacia chundra*, 6. *Brassica juncea*, 7. *Sterculia urens*, 8. *Tridax procumbens*, 9. *Dillenia pentagyna*, 10. *Combretum indicum*, 11. *Lagestromia parviflora*, 12. *Crotan banplandianus*, 13. *Evolvulas alsinoides*, 14. *Ailianthus excelsa*, 15. *Trichilia connaroides*, 16. *Annona squamosa*, 17. Urticaceae type, 18. *Eucalyptus globulus*, 19. *Vernonia cinerea*, 20. *Alangium salvifolium*, 21. *Dendrophthoe falcata*, 22. *Centipeda minima*, 23. *Xanthium strumerium*, 24. *Hyptis suaveolens*, 25. *Memecylon edule*, 26. *Corchorus fascicularis*, 27. *Rungia repens*, 28. *Impatiens balsamina*, 29. *Blepharis maderaspatensis*, 30. *Cleome gynandra*, 31. *Neptunia triquetra*. 32. *Lannea coromandalica*, 33. *Sapindus laurifolius*, 34. *Syzygium cumini*, 35. *Cocos nucifera*, 36. *Schleichera oleosa*, 37. *Cassia occidentalis*.

**Table 2. List of pollen taxa and their families in the honey samples.**

| Family | Pollen taxa |
|---|---|
| Asteraceae | *Tridax procumbens, Vernonia cinerea, Ageratum conyzoides, Gnaphalium polycaulon, Xanthium strumarium,Centipeda minima, Pulicaria foliosa.* |
| Mimosaceae | *Mimosa pudica, Albizia lebbeck, Prosopis juliflora, Acacia chundra, Neptunia triquetra,* |
| Malvaceae | *Bombax ceiba, B. malabaricum, Ceiba pentandra, Guazuma ulmifolia* |
| Myrtaceae | *Syzygium cumini, Eucalyptus globulus, Psidium guajava* |
| Arecaceae | *Cocos nucifera, Borassua flabellifer, Phoenix sylvestris* |
| Anacardiaceae | *Spondias pinnata, Lannea coromandelica, Annona squamosa* |
| Fabaceae | *Crotalaria juncea, Delonix regia, Erythrina indica* |
| Acanthaceae | *Justicia procumbens, Blepharis maderaspatensis, Rungia repens* |
| Tiliaceae | *Corchorus fascicularis, Grewia multifloral* |
| Sapindaceae | *Schleichera oleosa, Sapindus laurifolius,* |
| Combritaceae | *Terminalia arjuna, Combretum indicum* |
| Lamiaceae | *Hyptis suaveolens, Ocimum americanum* |
| Brassicaceae | *Brassica nigra, B. juncea.* |
| Euphorbiaceae | *Ricinus communis, Croton bonplandianus* |
| Convolvulaceae | *Jacquemontia paniculata, Evolvulas alsinoides* |
| Solanaceae | *Datura inoxia,Solanum trilobatum* |
| Sterculiaceae | *Sterculia urens, S. foetida* |
| Sapotaceae | *Madhuca longifolia* |
| Cucurbitaceae | *Cucumis melo* |
| Celastraceae | *Celastrus paniculata* |
| Loranthaceae | *Dendrophthoe falcata* |
| Violaceae | *Hybanthus enneaspermus* |
| Rubiaceae | *Gardenia lucida* |
| Meliaceae | *Trichilia connaroides* |
| Alangiaceae | *Alangium salvifolium* |
| Melastomaceae | *Memecylon edule* |
| Capparidaceae | *Cleome gynandra* |
| Flacourtiaceae | *Casearia elliptica* |
| Commellinaceae | *Commelina* sp. |
| Verbenaceae | *Stachytarpheta indica* |
| Malpighiaceae | *Aspidopterys indica* |
| Caesalpiniaceae | *Cassia occidentalis* |
| Poaceae | *Saccharum officinarum* |
| Balsaminaceae | *Impatiens balsamina* |
| Simaroubaceae | *Ailanthus excelsa* |
| Lythraceae | *Lagerstroemia parviflora* |
| Dilleniaceae | *Dillenia pentagyna* |
| Rutaceae | *Feronia elephantum* |
| Asclepiadaceae | *Gymnema sylvestris* |
| Urticaceae | Urticaceae type |

*pinnata* (24%); I: *Syzygium cumini* (8%); M: *Tridax procumbens* (2%), *Lannea coromandelica* (1%), *Hyptis suaveolens* (1%), *Gardenia lucida* (1%), *Vernonia cinerea* (1%), *Aspidoptrys indica* (1%), *Impatiens balsamina* (2%), *Hybanthus enneaspermus* (2%), *Bombax ceiba* (2%)

**V-P-G-Ge-tri-75:** P: Nil; S: *Ageratum conyzoides* (34%), *Mimosa pudica* (32%); I: *Crotalaria juncea* (4%), *Terminalia arjuna* (4%), *Feronia elephantum* (7%), *Tridax procumbens* (3%), *Delonix regia* (3%), *Brassica nigra* (4%); M: *Celastrus paniculata* (2%), *Albizia lebbeck* (2%), *Phoenix sylvestris* (1%), *Gnaphalium polycaulon* (2%), *Aspidopterys indica* (1%), *Ocimum americanum* (1%)

**V-P-G-Ro-tri-76:** P: Nil; S: *Sapindus laurifolius* (35%), *Bombax malabaricum* (%28); I: *Madhuca longifolia* (7%), *Erythrina indica* (4%), *Eucalyptus globulus* (4%), *Ceiba pentandra* (4%), *Ricinus communis* (3%), *Prosopis juliflora* (7%); M: *Syzygium cumini* (2%), *Cucumis melo* (2%), *Dendrophthoe falcata* (1%), *Gardenia lucida* (1%), *Justicia procumbens* (1%), *Jacquemontia paniculata* (1%),

**V-P-G-Sad-tri-77:** P: *Ageratum conyzoides* (57%); S: *Mimosa pudica* (22%); I: *Crotalaria juncea* (8%), *Terminalia arjuna* (3%), *Tridax procumbens* (3%); M: *Delonix regia* (2%), *Acacia chundra* (2%), *Combretum indicum* (1%), *Saccharum officinarum* (2%).

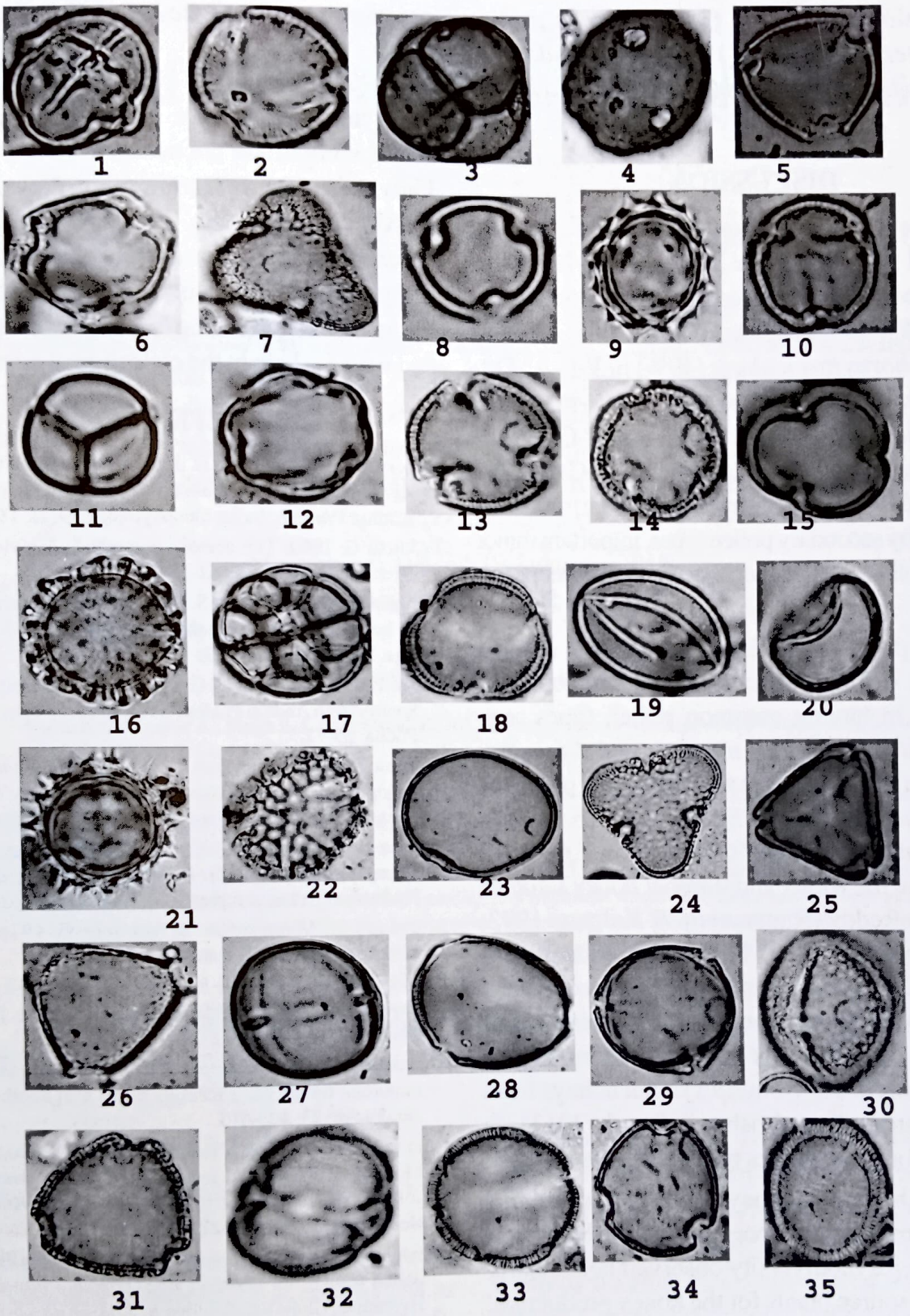
**V-P-G-Ko-tri-78:** P: *Trichilia connaroides* (86%); S: Nil; I: *Alangium salvifolium* (4%), *Gardenia lucida* (3%), *Bombax malabaricum* (3%); M: *Memecylon edule* (2%), *Jacquemontia paniculata* (2%)

**V-P-G-Bo-tri-79:** P: Nil; S: *Sapindus laurifolius* (44%), *Schleichera oleosa* (40%); I: *Lannea coromandelica* (10%), *Cleome gynandra* (6%); M: Nil

**V-P-G-Kp-tri-80:** P: Nil; S: *Guazuma ulmifolia* (36%), *Sapindus laurifolius* (17%); I: *Schleichera oleosa* (14%), Urticaceae type (11%), *Syzygium cumini* (11%), *Stachytarpheta indica* (4%), *Erythrina indica* (5%); M: *Lannea coromandelica* (2%)

**V-P-G-Ra-tri-81:** P: Nil; S: *Cocos nucifera* (41%), *Datura inoxia* (35%); I: *Jacquemontia paniculata* (15%), *Neptunia triquetra* (9%); M: Nil.

**V-P-G-Km-tri-82:** P: *Guazuma ulmifolia* (50%); S: *Schleichera oleosa* (18%); I: *Casearia elliptica* (7%), Urticaceae type (7%), *Commelina* sp.




## Plate 2

All figures ×500

1. *Solanum trilobatum*, 2. *Spondias pinnata*, 3. *Gardenia lucida*, 4. *Aspidopterys indica*, 5. *Guazuma ulmifolia* 6. *Hybanthus enneaspermus*, 7. *Bombax cieba*, 8. *Crotalaria juncea*, 9. *Ageratum conyzoides*, 10. *Sterculia foetida* 11. *Mimosa pudica*, 12. *Terminalia arjuna*, 13. *Celastrus paniculatus*, 14. *Feronia elephantum*, 15. *Casearia elliptica*, 16. *Delonix regia*, 17. *Albizia lebbeck*, 18. *Brassica nigra*, 19. *Phoenix sylvestris*, 20. *Commelina* sp. 21. *Gnaphalium polycaulon*, 22. *Ocimum americanum*, 23. *Saccharum officinarum*, 24. *Bombax malabaricum*, 25. *Stachytarpheta indica* 26. *Erythrina indica*, 27. *Madhuca longifolia*, 28. *Cucumis melo*, 29. *Ricinus communis*, 30. *Grewia multiflora* 31. *Ceiba pentandra*, 32. *Justicia procumbens*, 33. *Jacquemontia paniculata*, 34. *Prosopis juliflora*, 35. *Datura inoxia*.

(3%), *Cassia occidentalis* (3%), *Mimosa pudica* (6%); M: *Sterculia foetida* (1%), *Grewia multiflora* (1%), *Trichilia connaroides* (2%), *Gardenia lucida* (2%).

## DISCUSSION

The present study shows both unifloral and multifloral honeys. Five honey samples were characterized by the presence of predominant pollen types, viz. *Psidium guajava* (81%) in V-P-Mu-La-tri-39, *Corchorus fascicularis* (49%) in V-P-Ar-Du-tri-71, *Ageratum conyzoides* (57%) in V-P-G-Sad-tri-77, *Trichilia connaroides* (86%) in V-P-G-Ko-tri-78 and *Guazuma ulmifolia* (50%) in V-P-G-Km-tri-82. The remaining twelve honey samples were multifloral represented by secondary pollen types, important minor and minor pollen types, as mentioned above under pollen analysis.

Present pollen assemblage is comparable with the nectar and pollen sources of *Trigona* bees of Hyderabad in having common pollen types, e.g. *Prosopis juliflora, Cocos nucifera* and *Ageratum conyzoides* (Ramanujam et al. 1993). The pollen of *Psidium guajava* from Rajahmundry in Andhra Pradesh (Jhansi & Ramanujam 1986), *Ageratum conyzoides* in the winter and summer honey samples from Ranga Reddy (Ramanujam & Kalpana 1992; Ramanujam et al. 1992; Kalpana & Ramanujam 1994), *Psidium guajava* and *Ageratum conyzoides* in the *Apis cerana* honey samples from urban areas of Hyderabad city (Khatija & Ramanujam 1993), *Ageratum conyzoides* from *Apis florea* honeys from Adilabad district (Ramakrishna & Swathi 2013) are also recorded as predominant types in the present study.

Although *Trigona* honeys have more medicinal value, their production of honey is less than that of *Apis* honeys. The palynodiversity observed here clearly signifies the source plants for the honey production. Hence this study is may be useful to improve apiculture with *Trigona* bees in Paderu Forest Division by knowing source plants and source localities for production of more honey of medicinal value.

## ACKNOWLEDGEMENTS

The authors are grateful to Prof. C. G. K.Ramanujam for encouragement and guidance, to University Grants Commission, New Delhi (BSR-RFSMS Scheme No. F.5-80/2007) for financial assistance to one of the authors (RD), to the Principal, University College of Science, Saifabad, O.U., Hyderabad for providing laboratory facilities and to Dr. Padal for his help in the collection of honey samples.

## REFERENCES

Devender R., Ramakrishna H. & Padal S. B. 2014. Pollen diversity in *Apis* honeys of Narsipatnam Forest, Visakhapatnam District, Andhra Pradesh, India. Geophytology 44(2): 181-187.

Erdtman G. 1960. The acetolysis method. A revised description. Svens. Bot.Tidskr.54:561-564.

Harugade S. & Chaphalkar S. 2013. Floristic studies with reference to honey bees of Baramati, Pune district. Int. J. Advancements Res. Tech. 2(8): 178-187.

Jhansi P. & Ramanujam C. G. K 1986. Pollen analysis of unifloral honeys from Andhra Pradesh. Proc. Spec. Geophytological Conf., Poona: 69-72.

Kalpana T. P. & Ramanujam C. G. K 1994. *Carum capticum* - A major source of winter honeys in Ranga Reddy district, Andhra Pradesh. Proc. Indian Natn. Sci. Acad., Part B 60: 583-593.

Khatija F. & Ramanujam C. G. K. 1993. Pollen and chemical characterization of *Apis cerana* and *A. florea* honeys from Hyderabad Urban complex. J. Palynol. 29: 59-67.

Louveaux J., Maurizio A. & Vorwohl G. 1978. Methods of melissopalynology. Bee World 59: 139-157.

Ramakrishna H. & Swathi S. 2013. Pollen diversity is some *Apis florea* honeys from Adilabad district, Andhra Pradesh, India. Geophytology 42(1): 11-20.

Ramanujam C. G. K. & Kalpana T. P. 1992. *Tamarindus indica* L.: an important forage plant for *Apis florea* F in South-Central India. Apidologie 23: 403-413.

Ramanujam C. G. K., Kalpana T. P. & Khatija F. 1992. Melittopalynology and recognition of major nectar and pollen source for honey bees in some districts of Andhra Pradesh. Geophytology 22: 261-271.

Ramanujam C. G. K., Khatija F. & Kalpana T. P. 1993. Nectar and pollen sources for Dammer Bee (*Trigona iridipennis* Smith) in Hyderabad (India). Indian Bee Jl. 55(1-2): 25-28.

Suresh Kumar M., Ranjit Singh A. J. A. & Alagumuthu G. 2012. Traditional beekeeping of stingless bee (*Trigona* sp.) by Kani tribes of Western Ghats, Tamil Nadu, India. Indian J. Traditional Knowledge 11(2): 342-345.