MELLIFERA RESEARCH ARTICLE

Comparative Pollen Analysis of *Apis Cerana* Fabricius and *A. Mellifera* L. Honey Samples from Guntur, Sothern India

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A B S T R A C T

The present paper incorporates comparative pollen analysis of *A.cerana* Fabricius and *A. mellifera* L. samples belong to summer season of 2008-2009 from Guntur district, Andhra Pradesh. Total 32 pollen taxa belong to 22 families were identified. Out of 32 pollen taxa 10 pollen taxa were commonly encountered in both summer honeys of A.cerana and *A. mellifera*. Borassus flabellifer pollen are predominant in two samples of *A. mellifera*, and remaining 9 samples were multiflora.

Apis cerana, an Indian honey bee and *A. mellifera*, an European bee, are domesticated bees which are useful for honey production through apiary. The size of the honey bee and foraging area of *A.cerana* are small when compare to *A.mellifera*, Hence the number of pollen in honey samples of *A.cerana* are lesser than *A. mellifera* due to less coverage by *A.cerana* bees for nectar and pollen. Guntur district have a good potential for sustaining beekeeping ventures because of the diversity of nectar taxa.

Keywords: Pollen analysis, Honey samples, Guntur district

Introduction

Melissopalynological study finds a very significant application in the field of apiculture. Pollen analysis provides relevant information on the nectar sources of an area helps us to recognize its potential for apiary industry. Guntur district is a rich source for honey production with *A. cerana* and *A. mellifera* through apiculture.

The physical characteristics of *Apis cerana* are very like that of *Apis mellifera*. *A. cerana* adults have branched (plumose) hairs on their bodies to assist in pollen collection. Their workers have a corbiculum (pollen basket) on their hind legs to transport pollen. The worker's ovipositor (an organ for egg laying) has been modified into a stinger and adults are yellow and black in color. The abdominal stripes (tomenta) of *A. cerana* are more pronounced than those of *A. mellifera*. *A. cerana* workers have four abdominal stripes, whereas *A. mellifera* workers have three abdominal stripes. Worker bees body size varies among subpopulations throughout *A. cerana*'s geographic distribution.

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Generally, workers of *A. cerana* are smaller than *A. mellifera* workers. *A. cerana* prefers to nest in enclosed cavities, like a hollow tree. *A. cerana* colonies consist of approximately 34,000 bees, while *A.mellifera* colonies have average between 20,000 and 60,000 bees.

Both *A. cerana* and *A. mellifera* build multiple combs arranged parallel to one another. *A. cerana* does not use propolis, a glue-like material, to seal cracks and holes in their hives, as does *A. mellifera*. Behaviorally, *A. cerana* is almost indistinguishable from *A. mellifera*. *A. cerana* is known to be a very docile, gentle, and even somewhat timid, but there can be significant differences in their defensiveness depending on season and region. *A. cerana* colonies tend to swarm and abscond (abandon a hive location) more frequently than do *A. mellifera* colonies. *A. mellifera* workers face the hive entrance, but *A. cerana* workers face away from the colony entrance.

Melissopalynological study of *Apis cerana* indica was already studied earlier from Bhimtal in the Kumaon Himalaya during autumn season and recorded unifloral pollen loads of dominant Asteraceae types followed by Poaceae, Lamiaceae and Fabaceae [1]. And from Sikkim, Darjeeling and West Dinajpur during summer and recorded unifloral and multifloral types [2], *Apis mellifer* honeys from Guntur district [3]. The present work is also comparable with honey samples from Sunderbans during summer [4] and Bankura district, in summer season [5, 6] and from Uttarakhand, Uttar Pradesh [7], Orissa, West Bengal [8] and Khallagaon, Kanchanpur district, West Nepal [9].

The pollen characterization and quantification of honeys constitute a 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.

Materials and Methods

Total eleven honey samples of *A. cerana* and *A.mellifera* were collected from various villages in Guntur district, Andhra Pradesh (Latitudes 16° 20' N; Longitudes 80° 27' E (Figure 1), which is the rich source for honey production during March, April and May months of summer season (Table 1) and were processed by using Erdtman's acetolysis technique [10] and prepare three slides for each sample and recorded pollen types and identified with the help of reference pollen slides and relevant literature. The recorded pollen types were taken pollen photomicrographs with help of Olympus trinocular research microscope in Palaeobotany and Palynology laboratory, Dept. of Botany, University College of Science, Saifabad, Osmania University Hyderabad (Plate 1, 2). Recorded pollen in these honey samples are classified as predominant pollen type-P (45% >), secondary pollen type-S (16-45%), important minor pollen type-I (3- <16%) and minor pollen type-M (< 3%) based on their frequencies [11] and prepared pie chats (Figure 2, 3).

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Table 1. Inventory of the summer honey samples of *Apis cerana* and *A. mellifera*

A. samples of *Apis cerana*

S.No.	Sample code	District	Mandal	Village	Date of collection
1	G-T-Ka-Ac8	Guntur	Tenali	Katevaram	02-04-2008
2	G-D-E-Ac9	Guntur	Duggirala	Emani	05-03-2008
3	G-K-K-Ac10	Guntur	Kollipara	Kollipara	12-03-2008
4	G-Ck-Kv-Ac11	Guntur	Cherukupalle	Kavuru	04-04-2008

B. samples of *Apis mellifera*

S.No.	Sample code	District	Mandal	Village	Date of collection
1	G-T-Ko-Am25	Guntur	Tenali	Kolakaluru	10-04-2008
2	G-T-Ko-Am26	Guntur	Tenali	Kolakaluru	19-05-2008
3	G-T-Ko-Am27	Guntur	Tenali	Kolakaluru	15-03-2009
4	G-T-Ka-Am28	Guntur	Tenali	Katevaram	28-03-2009
5	G-D-E-Am29	Guntur	Duggirala	Emani	06-04-2008
6	G-Ts-Y-Am30	Guntur	Tsundur	Yedlapalli	16-05-2008
7	G-Ts-Y-Am31	Guntur	Tsundur	Yedlapalli	08-03-2009

Table 2. Pollen frequency and comparison of summer honeys of *Apis cerana* and *Apis mellifera*

S.No	Family	Pollen taxa	*A.cerana*	Frequency (%)	*A. mellifera*	Frequency (%)
1	Acanthaceae	*Hygrophila auriculata*	_	-	+	14.28%
		Justicia procumbens	+	50%	+	28.57%
2	Amaranthaceae	*Amaranthus viridis*	+	25%	+	42.85%
3	Arecaceae	*Borassus flabellifer*	+	75%	+	100%
		Cocos nucifera	+	50%	+	57.14%
		Phoenix sylvestris	+	75%	_	-
4	Apiaceae	*Coriandrum sativum*	+	25%	+	14.28%

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5	Asteraceae	*Tridax procumbens*	_	-	+	42.85%
		Helianthus annuus	_	-	+	28.57%
6	Bombacaceae	*Ceiba pentandra*	+	50%	_	-
7	Brassicaceae	*Brassica nigra*	+	50%	+	14.28%
8	Caesalpiniaceae	*Caesalpinia bonduc*	_	-	+	14.28%
9	Cucurbitaceae	*Cucumis sativus*	_	-	+	28.57%
10	Euphorbiaceae	*Croton bonplandianus*	_	-	+	14.28%
11	Fabaceae	*Pongamia pinnata*	_	-	+	14.38%
12	Flacourtiaceae	*Casearia elliptica*	_	-	+	28.57%
13	Lamiaceae	*Leucas aspera*	+	50%	_	-
14	Lythraceae	*Lagerstroemia parviflora*	_	-	+	42.85%
15	Mimosaceae	*Albizia lebbeck*	+	25%	_	-
		Mimosa pudica	+	50%	+	14.28%
		Prosopis juliflora	_	-	+	14.28%
16	Myrtaceae	*Psidium guajava*	+	50%	+	42.85%
		Eucalyptus globulus	_	-	+	42.85%
17	Pedaliaceae	*Sesamum indicum*	+	25%	+	14.28%
18	Poaceae	*Grass pollen*	+	75%	+	42.85%
		Zea mays	_	-	+	42.85%
19	Punicaceae	*Punica granatum*	_	-	+	14.28%
20	Rutaceae	*Feronia elephantum*	+	25%	_	-
		Citrus limon	_	-	+	14.28%
21	Sapindaceae	*Sapindus emarginatus*	_	-	+	14.28%
		Schleichera oleosa	_	-	+	14.28%
22	Solanaceae	*Capsicum frutescens*	_	-	+	14.28%

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Figure 1. Study area of honey samples from Guntur district

Results and Discussion

All the honey samples were palynologically scanned and recorded the 32 pollen taxa viz., *Hygrophila auriculata* (Schumach.) Heine, *Justicia procumbens* L., *Amaranthus viridis* L., *Borassus flabellifer* L., *Cocos nucifera* L., *Phoenix sylvestris* (L.) *Roxb., Coriandrum sativum* L., *Tridax procumbens* L., *Helianthus annuus* L., *Ceiba pentandra* (L.) Gaertn., *Brassica nigra* (L.) K.Koch., *Caesalpinia bonduc* (L.) Roxb., *Cucumis sativus* L., *Croton bonplandianus* Baill., *Pongamia pinnata* (L.) Pierre., *Casearia elliptica* Willd., *Leucas aspera* (Willd.) Link, *Lagerstroemia parviflora* Roxb., *Albizia lebbeck* (L.) Benth., *Mimosa pudica* L., *Prosopis juliflora* (Sw.) DC., *Psidium guajava* L., *Eucalyptus globulus* Labill., *Sesamum indicum* L., Grass pollen, *Zea mays* L., *Punica granatum* L., *Feronia elephantum* Correa., *Citrus limon* (L.) Osbeck., *Sapindus emarginatus* Vahl., *Schleichera oleosa* (Lour.) Merr. and *Capsicum frutescens* L. belong to 22 families (Plate 1,2: Table 2).

Two of eleven honey samples were found to be unifloral and nine were multifloral. The unifloral samples were represented with predominant pollen type was *Borassus flabellifer* in two samples viz., 55.24% in G-T-Ka-Am28 and 66.66% in G-D-E-Am29.

Frequency distribution of Apis cerana summer honey samples

Pollen of *Borassus flabellifer*, *Phoenix sylvestris* and Grass pollen were recorded as "very frequent" class. All these types showed 75-80% pollen occurrence. The class "frequent" represented twelve pollen types viz., *Cocos nucifera, Mimosa pudica, Brassica nigra, Leucas aspera, Justicia procumbens, Ceiba pentandra, Albizia lebbeck, Feronia elephantum, Psidium guajava, Amaranthus viridis, Coriandrum sativum* and *Sesamum indicum*. The "infrequent" and "rare" classes were absent.

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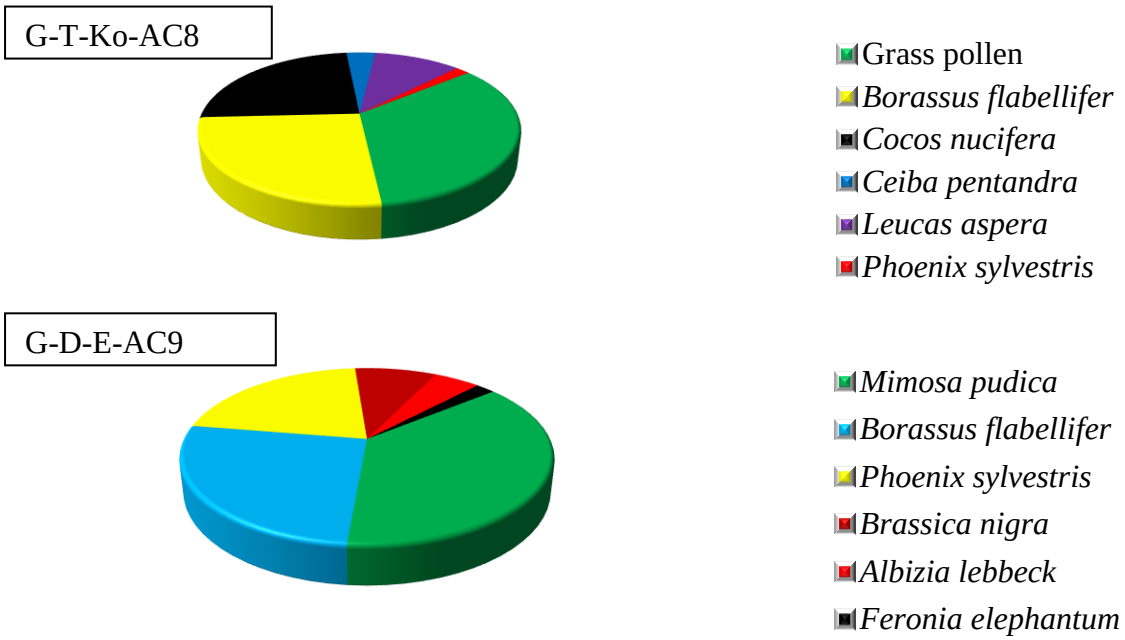
Altogether fifteen pollen types referable to twelve families were identified from summer honey samples of *Apis cerana*. Of the fifteen pollen types three were referable to Arecaceae family, two pollen types were referable to Mimosaceae family, one pollen type for each belong to Poaceae, Brassicaceae, Lamiaceae, Acanthaceae, Bombacaceae, Myrtaceae, Amaranthaceae, Rutaceae, Apiaceae and Pedaliaceae (Table 2).

Frequency distribution of Apis mellifera summer honey samples

Pollen of *Borassus flabellifer* and *Cocos nucifera* were recorded as "very frequent" class, among these *Borassus flabellifer* showed 100% pollen occurrence. The class "frequent" represented by *Tridax procumbens, Amaranthus viridis, Eucalyptus globulus, Psidium guajava, Zea mays,* Grass pollen, *Casearia elliptica, Cucumis sativus, Helianthus annuus, Justicia procumbens* and *Lagerstroemia parviflora*. The "infrequent" class represented by the pollen of *Sesamum indicum, Citrus limon, Capsicum frutescens, Mimosa pudica, Sapindus emarginatus, Brassica nigra, Hygrophila auriculata, Prosopis juliflora, Croton bonplandianus, Punica granatum, Pongamia pinnata, Caesalpinia bonduc, Coriandrum sativum* and *Schleichera oleosa*. The "rare" class was absent.



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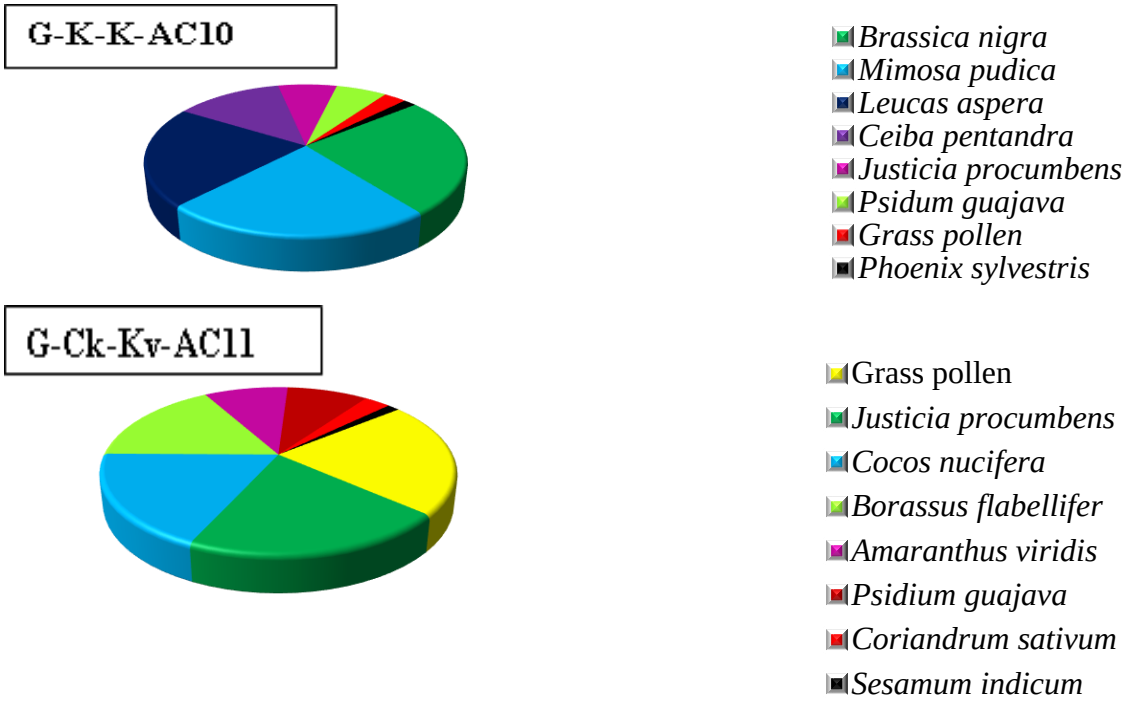
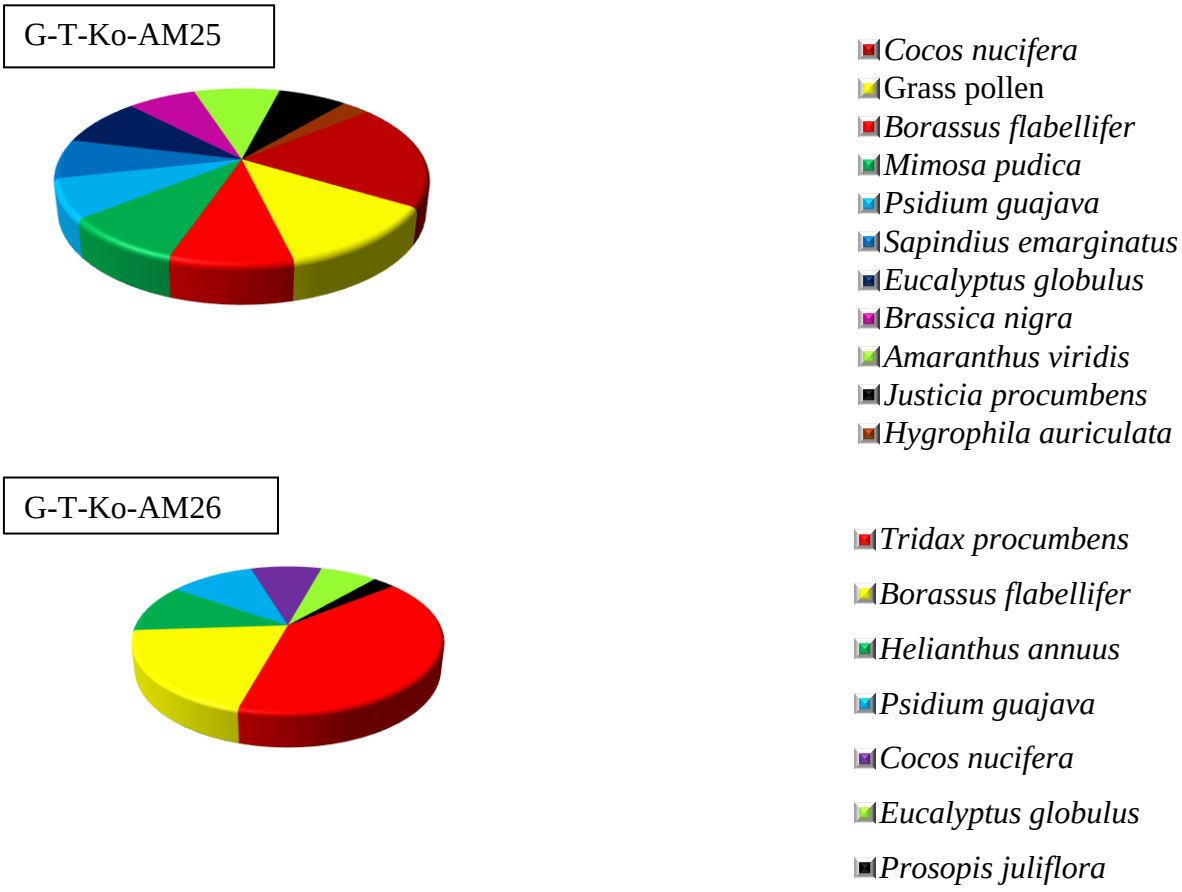


Figure 2. The pollen spectra of *A.cerana* honey samples during summer season



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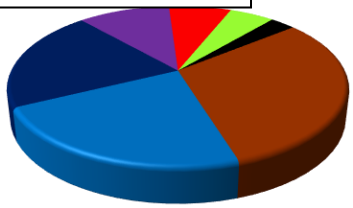
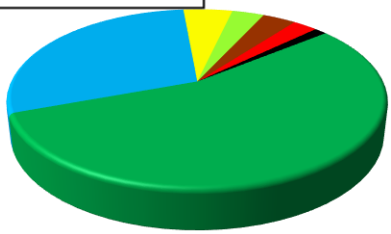
G-T-Ko-AM27



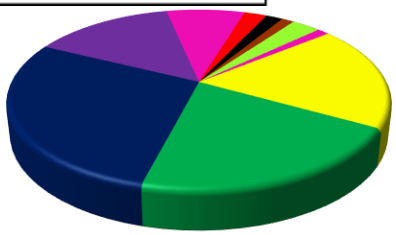
- Grass pollen
- *Borassus flabellifer*
- *Lagerstroemia parviflora*
- *Zea mays*
- *Cucumis sativus*
- *Tridax procumbens*
- *Amaranthus viridis*

G-T-Ka-AM28



- *Borassus flabellifer*
- *Zea mays*
- *Psidium guajava*
- *Casearia elliptica*
- *Cocos nucifera*
- *Lagerstroemia parviflora*
- *Croton bonplandianus*

G-Ts-V-AM30



- *Cocos nucifera*
- *Eucalyptus globulus*
- *Borassus flabellifer*
- *Capsicum frutescens*
- *Casearia elliptica*
- *Punica granatum*
- *Pongamia pinnata*
- *Caesalpinia bonduc*
- *Coriandrum sativum*
- *Schleichera oleosa*

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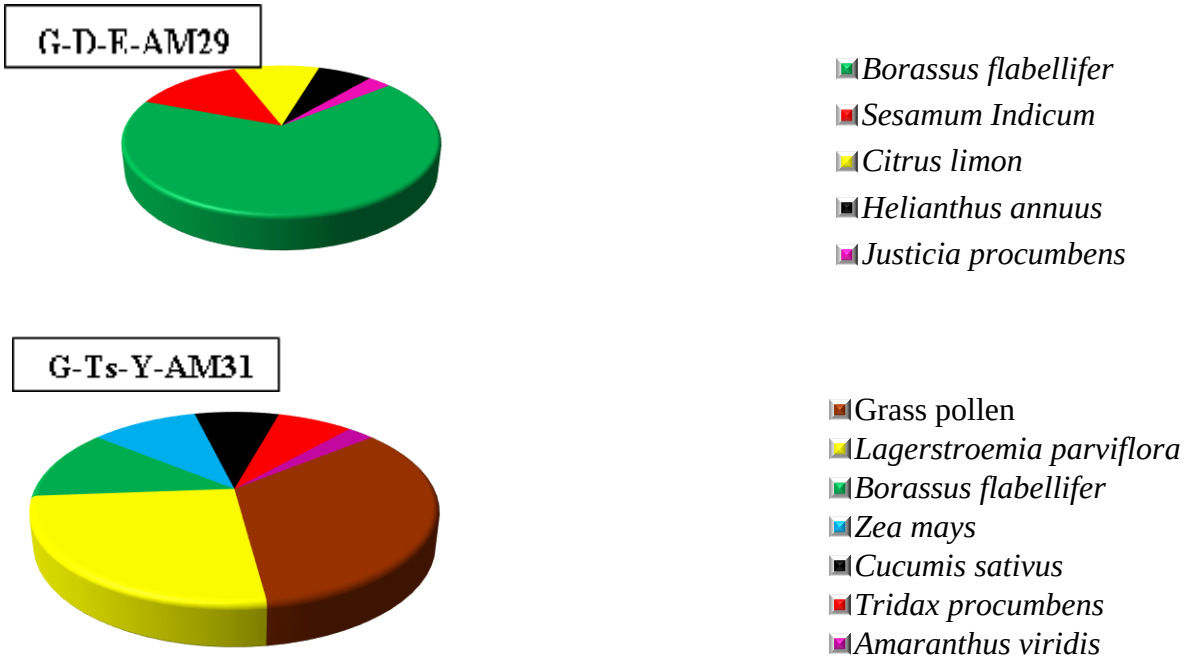

Figure 3. The pollen spectra of *A. mellifera* honey samples during summer season

Altogether twenty-seven pollen types referable to twenty families were identified from summer honey samples of *Apis mellifera*. Of the twenty-seven pollen types, two of each were referable to Acanthaceae, Arecaceae, Asteraceae, Mimosaceae, Myrtaceae, Poaceae and Sapindaceae families and one of each was referable to all the remaining families viz., Amaranthaceae, Apiaceae. Brassicaceae, Caesalpiniaceae Cucurbitaceae, Euphorbiaceae, Fabaceae, Flacourtiaceae, Lythraceae, Pedaliaceae, Punicaceae Rutaceae and Solanaceae (Table 2).

The present study clearly indicates that the honeys of Guntur district possess strong palynological similarity with the Visakhapatnam, Adilabad, Medak and Nizamabad districts, South India, Kanchanpur district Nepal honey samples.

The pollen types of Tridax procumbens, Leucas aspera, Schleichera oleosa, Eucalyptus globulus, Psidium guajava, Mimosa pudica, Prosopis juloflora, Borassus flabellifer, Phoenix sylvestris and Justicia procumbens are recorded in the honeys of both Visakhapatnam and Guntur districts [12,13]. The pollen the honeys of Guntur district viz., Borassus flabellifer, Amaranthus sp., Sesamum indicum, Prosopis juliflora and Phoenix sylvestris are common pollen types in the honeys of Southern Telangana [14]. The pollen in the honey samples of Gunter district viz., Borassus flabellifer, Brasica nigra, Hygrophila auriculata, Helianthus annuus, Tridax procumbens, Eucalyptus globulus, Psidium guajava, Justicia procumbens, Coriandrum sativum, Poaceae type and Zea mays were identified in the honeys of Adilabad district [15]. The commonly

recorded pollen types in Medak and Guntur districts are Phoenix sylvestris, Helianthus annuus, Tridax procumbens, Brassica nigra, Prosopis juloflora, Eucalyptus globulus and Coriandrum sativum [16]. The pollen in the honeys of Guntur district viz., Helianthus annuus, Scleichera oleosa, Phoenix syvestris and Sesamum indicum are commonly encountered in the honeys of Nizamabad district [17]. The pollen in the honeys of Guntur district viz., Borassus flabellifer, Cocos nucifera, Phoenix sylvestris, Mimosa pudica and Asteraceae family are commonly recorded from honeys of South India [18].

The present recorded results are also comparable with the honeys of *Apis mellifera* from Saudi Arabia [19], from shiwalik hills in India [20], from Muzaffarpur in Bihar [21], from Karnataka [22], two coastal district of Orissa [23], Varanasi district Uttar Pradesh [24], South Gujarath [25] West Bengal [26] and Eastern Himalayan Part of West Bengal [27].

A total number of 32 pollen types were recorded from both *Apis cerana* and *Apis mellifera* during summer season. Of these 32 pollen types, 10 pollen types viz., *Amaranthus viridis, Borassus flabellifer, Brassica nigra, Cocos nucifera, Coriandrum sativum,* Grass pollen, *Justicia procumbens, Mimosa pudica, Psidium guajava* and *Sesamum indicum* were commonly encountered in both summer honey samples of Indian hive bees (*Apis cerana*) and European honey bees (*Apis mellifera*). Hence these plants are the common bee forage plants for *Apis* bees during summer season in Guntur district. The 5 pollen types viz., *Albizia lebbeck, Ceiba pentandra, Feronia elephantum, Leucas aspera* and *Phoenix sylvestris* were not recorded in *Apis mellifera* but were recorded in *Apis cerana* samples. The 17 pollen types viz., *Caesalpinia bonduc, Capsicum frutescens, Casearia elliptica, Citrus limon, Croton bonplandianus, Cucumis sativus, Eucalyptus globulus, Helianthus annuus, Hygrophila auriculata, Lagerstroemia parviflora, Pongamia pinnata, Prosopis juliflora, Punica granatum, Sapindus emarginatus, Schleichera oleosa, Tridax procumbens* and *Zea mays* were not recorded in *Apis cerana* but were recorded in *Apis mellifera* samples (Table 2).

Apis cerana, an Indian honey bee and *A. mellifera*, an European bee, are domesticated bees which are useful for honey production through apiary The size of the honey bee and foraging area of *Apis cerana* are small when compare to *Apis millefera,* Hence the number of pollen in honey samples of *Apis cerana* are lesser than *A. mellifera* due to less coverage by *A.cerana* bees for nectar and pollen. The information provided in this study of honey samples of apiary honey from Guntur district enable us to recognize these key bee foraging plants may profitably be utilized in the prospective bee-keeping enterprises of this district. Hence it denotes Guntur district is appropriate to develop apiary for more honey production due to diversity of bee foraging plants in the investigated area.

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PLATE-1

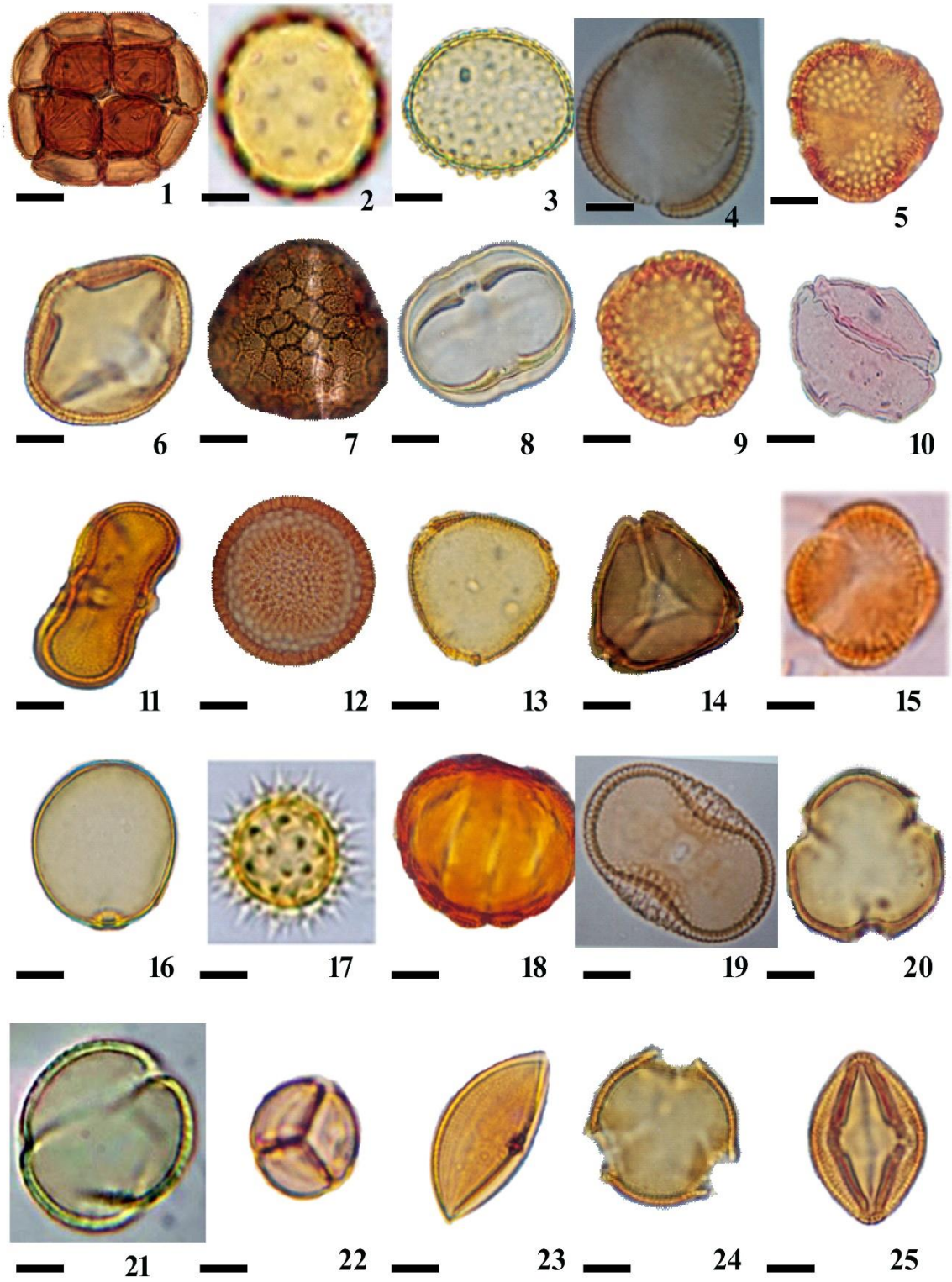

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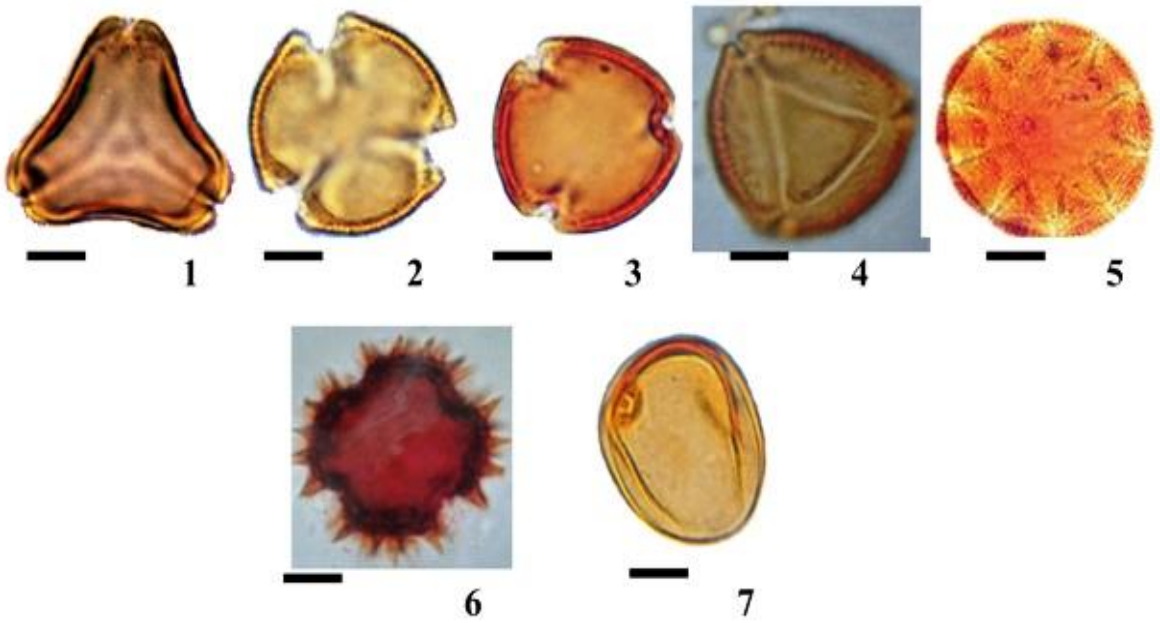
PLATE-2



Scale bar: 10µm

Explanation of the Plate-1

*1.Albizia lebbeck, 2.Amaranthus viridis, 3.Borassus flabellifer, 4.Brassica nigra, 5.Caesalpinia bonduc, 6.Capsicum frutescens, 7.Ceiba pentandra, 8.Casearia elliptica, 9.Citrus limon, 10.Cocos nucifera, 11.Coriandrum sativum12.Croton bonplandianus, 13.Cucumis sativus, 14.Eucalyptus globulus, 15.Feronia elephantum, 16.*Grass pollen*, 17.Helianthus annuus, 18.Hygrophila auriculata, 19.Justicia procumbens, 20.Lagerstroemia parviflora, 21.Leucas aspera, 22.Mimosa pudica, 23.Phoenix sylvestris, 24.Pongamia pinnata, 25.Prosopis juliflora*

Explanation of the Plate-2

1.Psidium guajava, 2.Punica granatum, 3.Sapindus emarginatus, 4.Schleichera oleosa, 5.Sesamum indicum, 6.Tridax procumbens, 7.Zea mays

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Guntur, Güney Hindistan Bölgesi'ne ait *Apis cerana* Fabricius ve *A. mellifera* L. bal örneklerinin karşılaştırmalı polen analizi

Öz: Mevcut çalışma Guntur bölgesi , Andhra Pradesh, 2008-2009 yılı yaz sezonuna ait *A.cerana* Fabricius ve *A. mellifera* L. örneklerinin polen içeriklerinin kıyaslanmasını kapsamaktadır. Toplamda 22 familyaya ait 32 polen taksası tanımlanmıştır. 32 taksa dışında, 10 taksaya hem *A.cerana* hemde *A. mellifera* yaz örneklerinde rastlanılmıştır. *Borassus flabellifer* poleni *A. mellifera*'nın iki örneğinde predominant olarak belirlenmiştir, kalan 9 örnek ise multifloral olarak belirlenmiştir.

Bir Hindistan arısı olan *Apis cerana* ve bir Avrupa arısı *A. mellifera*, arılıklarda bal üretimi için uygun türlerdir. *A.cerana* bal arısının büyüklüğü ve yağmalama alanı *A. mellifera'*ya oranla daha küçüktür. Bundan dolayı *A.cerana* bal örneklerindeki polen sayısı *A. mellifera* 'nınkinden daha azdır. Guntur bölgesi nektar kaynağının yayılımı açısından arıcılık için iyi bir potansiyeldir.

Anahtar Kelimeler: Polen analizi, Bal, Guntur bölgesi

R E F E RE N C E S

[1]GARG, A (1996) Palynocontents of Bee- Collected Pollen Loads of Autumn Season in Bhimtal, India. Taiwania 41 (3):197-207.

[2]BERA**,** S; MUKHOPADHYAY, S K; DHAR, J; DAS, A P; DE, S (1997) A melittopalynological investigation of *Apis cerana* indica Fabr. Summer honey from Sikkim And Sub-Himalayan West Bengal, India. J.Palynolo. 33: 128-209.

[3]MAMATHA, K; DEVENDER, R; GANGA KAILAS, J; NIRANJAN, S; RAMAKRISHA, H 2017 Pollen Diversity in *Apis mellifera* L. Honeys of Guntur district, Andhra Pradesh. Journal of Palynology 53: 83-94.

[4]JANA, D; BERA, S (2004) *Sonneratia apetala* Buch-ham as major nectar source for honey bees during mid-summer days in Sundarbans, West Bengal, India. Phytomorphology. 54 (1&2):51-57.

[5]BANDOPADHYAY, A; JANA, D; BERA, S (2005) Pollen analysis of winter honey samples from Bankura district, West Bengal. Geophytology. 35. 1&2: 1-6.

[6]BANDOPADHYAYA, A; BERA, S (2005) *Barringtonia acutangular* Gaertn: An important Bee forage plant. J. Bot.Soc. Bengal 59, 1&2: 43-46.

[7]DATTA, K; VERMA, P C; CHATTERJEE, A (2008) Mapping of key bee flora of upper Gangetic region of India- a palynological assessment through regional honeys. Grana. 47: 159-170.

[8]CHAKRABARTI, T; BHATTACHARYA, K (2011a) Vegetational impact over bee forage in relation to seasonal variation: An observation in some honey samples of West Bengal and Orissa. J. Palynol. 47: 69-76

[9]ANKIT K KANNANJIA; ALOK; MAHESH PRASAD (2014) Palynological investigation of honey from Khallagaon, Kanchanpur district, Westren Nepal, Geophytology 44(1):49-54

[10]ERDTMAN, G (1960) The acetolysis method. A revised description. Svens. Bot.Tidskr, 54:561-564.

[11]LOUVEAUX, J; MAURIZIO, A; VORWOHL, G (1978) Methods of melissopalynology, Bee World, 59:139-157.

[12]DEVENDER, R; RAMAKRISHNA, H (2015) Palynodiversity in *Trigona* honeys from Paderu Forest Division of Visakhapatnam district, Andhra Pradesh, India, Geophytology, 45(2): 221-226

[13]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.

[14]DEVENDER, R; GANGA KAILASH, J; RAMAKRISHNA, H (2016) Microscopical analysis of *Apis dorsata* and *Apis cerana* honeys from Southern Telangana State. Ad.Plant Sci, 29(I):27-33.

[15]RAMAKRISHNA, H; SWATHI, S (2013) Pollen diversity in some *Apisflorea* honeys from Adilabad district, Andhra Pradesh, India. Geophytology, 42 (1): 11-20.

[16]CHAYA, P K; VARMA, Y N R (2004) Pollen diversity in the honey samples from Medak district, Andhra Pradesh. Geophytology 34 (1&2):95-100.

[17]RAMAKRISHNA, H BHUSHAN, M (2004) Diversity in Pollen characterization of squeezed honey

Cite as: MAMATHA, K ; DEVENDER, R; KAILASH, J G; NIRANJA, S;RAMAKRISHNA, H (2018) Comparative pollen analysis of *Apis cerana* Fabricius and *A.mellifera* L. honey samples from Guntur, Sothern India, Mellifera, 18(1):1-14.

samples from Nizamabad district, Andhra Pradesh. Geophytology 34 (1&2):23-31.

[18]RAJA PONNUCHAMY; VINCENT BONHOMME; SRINIVASAN PRASAD; LIPI DAS; PRAKASH PATEL; CE´ DRICGAUCHEREL; ARUNACHALAM PRAGASAM; KRISHNAMURTHY ANUPAMA (2014) Honey Pollen: Using Melissopalynology to Understand Foraging Preferences of Bees in Tropical South India. PLoS ONE 9(7): e101618. doi:10.1371/journal.pone.0101618

[19]EL-KAZAFY ABDOU TAHA (2015) A study on nectar and pollen sources for honeybee, *Apis mellifera* L. in Al-Ahsa Saudi Arabia. Journal of Entomology and Zoology Studies. 3(3): 272-277

[20]AVINASH KAUR, V; MATTU, K (2016). Pollen Spectrum of honey samples of *Apis cerana* F. collected from different areas of Shiwalik hills. International Journal of Scientific Research And Education.4 (6): 5434-5440.

[21]SURYANARAYANA, M C; MOHANA RAO, G; SINGH, TSMS (1992) Studies on pollen sources for *Apis cerana* Fabr and *Apis mellifera* L bees at Muzaffarpur, Bihar, India. Apidologie. 23: 33-46.

[22]BHARGAVA, H R; JYOTHI, J V A; BHUSHANAM, M; SURENDRA, N S (2009) Pollen Analysis of *Apis* Honey, Karnataka, India. APIACTA 44:14-19.

[23]UPADYAY, DEBASIS; SWAPNA BHATTACHARYA; DAVID, K FERGUSON; SUBIR, BERA (2014) Prospects of Apicultural Entrepreneurship in Coastal districts of Eastern India: A Melissopalynological Evaluation. PLOS ONE Vol.9 (4): e94572.

[24]MANJU, SAHNEY; AJAY KUMAR ; SNEH LATA RAHI (2016) Pollen Analysis of Honeys from Varanasi District, Uttar Pradesh, India *Biological Forum – An International Journal* 8(2): 126-133.

[25]BEHERA, L K; MEHTA, A A; SINHA, S K (2014) Suitable bee flora availability for commercial apiculture during dearth period in the heavy rainfall zone of South Gujarat Res J. Chem. Environ. Sci. Vol 2 (6): 65-68.

[26]CHAKRABORTI, T; BHATTACHARYA, K (2011b) Floristic Composition and Physico-Chemical Parameters of Honey samples from West Bengal Indian J. Aerobiol., Vol 24, No. 2, 59-64.

[27]MUKHOPADHYAY; SAMIR KUMAR; SUDHA GUPTA; DAS, A P; SUBI, RBERA (2007) The beekeeping potential of Sub-Himalayan West Bengal, India: A palynological assessment of honey Journal of Apicultural Research and Bee World 46(3): 164–177.

Cite as: MAMATHA, K ; DEVENDER, R; KAILASH, J G; NIRANJA, S;RAMAKRISHNA, H (2018) Comparative pollen analysis of *Apis cerana* Fabricius and *A.mellifera* L. honey samples from Guntur, Sothern India, Mellifera, 18(1):1-14.