

MELISSOPALYNOLOGICAL INVESTIGATIONS ON ROCK BEE HONEYS FROM DECIDUOUS FORESTS OF E.GODAVARI DISTRICT OF ANDHRA PRADESH, INDIA.

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The present paper deals with the pollen analysis of twelve squeezed honey samples of *Apis dorsata* F. (rock bee) collected during March-July, 2008 from Rajavommangi and Eleswaram forest range of E. Godavari district of Andhra Pradesh, India. According to the pollen spectra, most of the samples (11) were unifloral (single source) and one multifloral. Majority of unifloral honeys i.e., 8 (72.7%) showed *Aspidopterys indica* as the predominant pollen type. *Borassus flabellifer*, *Sapindus emarginatus* and *Hygrophila auriculata* formed the predominant pollen type in one (9.1%) sample each. The other significant pollen types recorded include *Mimosa pudica*, *Terminalia arjuna*, *Dillenia pentagyna*, *Syzygium cumini*, *Abutilon indicum*, *Mimosa hamata*, *Lannea coromandelica*, *Aegle marmelos*, *Schleichera oleosa*, *Prosopis juliflora*, *Soymida febrifuga*, *Caesalpinia bonduc* etc. The study highlights the importance of *Aspidopterys indica* as the chief source of nectar for rock bees (*A. dorsata*) during summer in the forest range of E. Godavari district of Andhra Pradesh, India.

Key Words: Melissopalynology; rock bee honeys; E. Godavari district; Andhra Pradesh; India.

Bulk of honey (>60%) harvested in India comes from *Apis dorsata* F. (rock bee) combs. (Phadke 1968, 1986). These bees are most commonly and widely encountered in the forests of Indian sub continent. Adequate supplies of nectar and pollen together constitutes the nutritional requirements of honey bees and these are essential for the sustenance and multiplication of the bee hives leading to copious honey production.

Melissopalynological studies help to identify the chief / significant sources of nectar and pollen for honey bees in any locality and also facilitates identification of various unifloral or multifloral honeys.

The present investigation is aimed primarily at recognizing the chief/significant sources of nectar for *Apis dorsata* bees and the study deals with a critical microscopic analysis of the pollen contents of twelve squeezed honeys of *Apis dorsata* collected from Rajavommangi and Eleswaram forest ranges of

E. Godavari district of Andhra Pradesh, India.

MATERIALS AND METHODS

Twelve squeezed honey samples (150gms each) of *Apis dorsata* combs were collected from the deciduous forest of E. Godavari district of Andhra Pradesh, India, during summer months of 2006. Of these, eight samples were collected from Rajavommangi range and four from Eleswaram range. The inventory of honey samples is provided in Table-1. To the extent possible only the honey storing portion of the combs were pressed for the removal of honey.

The methodology recommended by the International Commission of Bee Botany (Louveaux *et al.* 1978) was employed for the recovery, analysis and quantification of the pollen contents of honey samples. Three slides were prepared for each sample for critical pollen study. The recovered pollen types were

Table 1 – Inventory of honey samples collected from East Godavari district.				
Sample code	Forest Range	Locality	Date of Collection	Colour
EG.R.S-1	Rajavommangi	Surampalem	2.5.2008	Amber
EG.R.A-2	„	Appalarajupeta	2.5.2008	„
EG.R.T-3	„	Tallapalem	2.5.2008	„
EG.R.K-4	„	Kindra	5.5.2008	„
EG.R.D-5	„	Damanapalem	8.5.2008	„
EG.R.Da-6	„	Dukarai	8.5.2008	„
EG.R.An-7	„	Ananthagiri	8.5.2008	„
EG.R.L-8	„	Lagarai	10.5.2008	„
EG.E.L-9	Eleswaram	Lodhoddi	8.4.2008	Yellow
EG.E.K-10	„	Kothapalli	8.4.2008	„
EG.E.S-11	„	Sidhivaripalem	8.4.2008	„
EG.E.M-12	„	Mathaiapeta	6.3.2008	„

identified with the help of reference palynoslides of the local flora.

On the basis of the frequency of distribution of the pollen types in the total contingent of honey samples (i.e. number of honey samples in which the various pollen types occurred), four discrete classes were recognized viz., very frequent (present in > 50% of the honey samples), Frequent (20-50%), infrequent (10-20%) and rare (<10%) (Feller and Demalsy *et al.* 1987).

RESULTS

Pollen analysis of twelve honey samples have revealed that eleven samples were unifloral and one multifloral. *Aspidopterys indica* in 8 (72.7%) samples, *Borassus flabellifer*, *Sapindus emarginatus* and *Hygrophila auriculata* in 1(9.1%) sample each represent the predominant pollen types in

the unifloral honeys.

Mimosa pudica, *Terminalia arjuna*, *Lannea coromandelica* and Euphorbiaceae type represents the secondary pollen types. The other note worthy pollen types (up to important minor category) include *Mimosa hamata*, *Abutilon indicum*, *Mimosa pudica*, *Eucalyptus globulus*, *Terminalia arjuna*, *Caesalpinia bonduc*, *Soymida febrifuga*, *Dillenia pentagyna*, *Syzygium cumini*, *Borassus flabellifer*, *Lannea coromandelica*, *Aegle marmelos*, *Schleichera oleosa*, *Prosopis juliflora*, *Ocimum basilicum* and *Ageratum conyzoides*. Table-2 provides detailed information on the frequency classes and frequencies of pollen types recorded in each honey sample. Figure 1-12 represents the pollen spectra of honey samples studied.

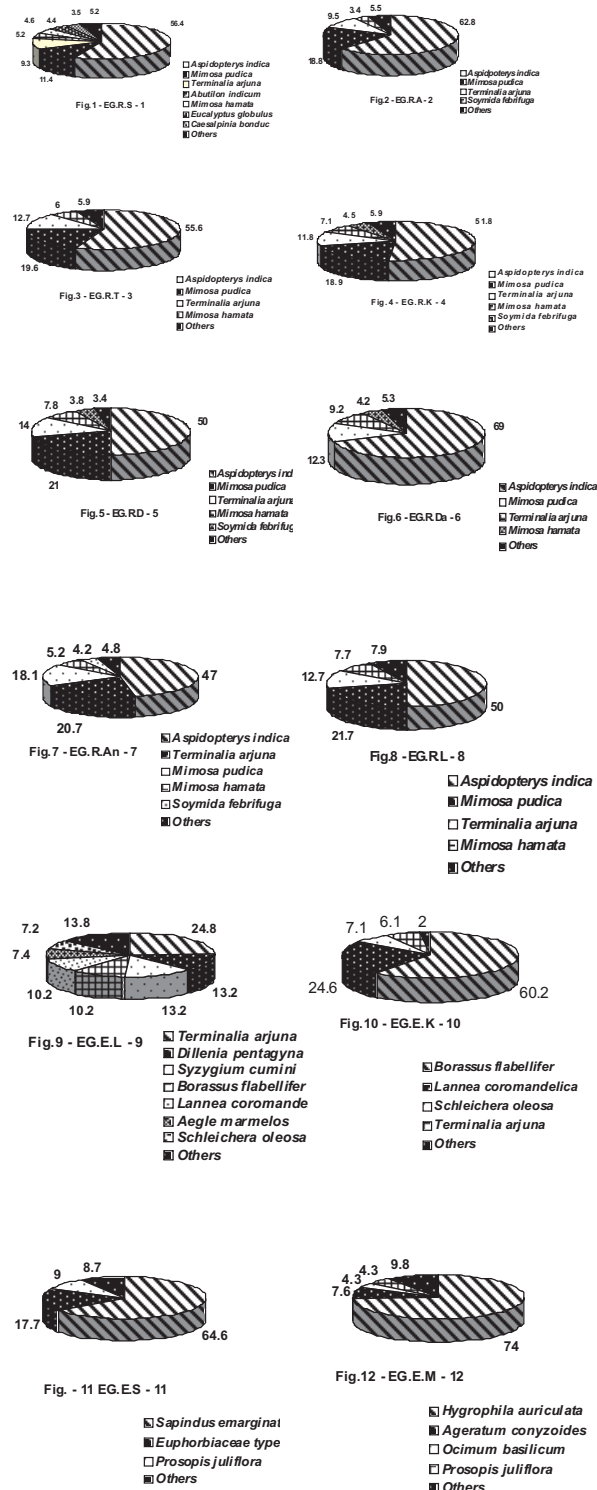
Altogether 40 pollen types of nectar producing taxa referable to 24 families were recorded from the honey samples studied.

Table – 2 Pollen analysis of honey samples studied.

Sample code	Nature of honey and frequencies (%) of pollen types
EG-R-S – 1	Unifloral P – <i>Aspidopterys indica</i> – 56.4 S – Nil IM – <i>Mimosa pudica</i> (11.4), <i>Terminalia arjuna</i> (9.3), <i>Abutilon indicum</i> (5.2), <i>Mimosa hamata</i> (4.6), <i>Eucalyptus globulus</i> (4.4), <i>Caesalpinia bonduc</i> (3.5) M – Cro., Dil., Coc., Bor., Alb., Ses., Soy. NMP – <i>Sorghum vulgare</i> (0.6)
EG -R -A -2	Unifloral P – <i>Aspidopterys indica</i> -62.8 S – <i>Mimosa pudica</i> - 18.8 IM – <i>Terminalia arjuna</i> (9.5), <i>Soyimida febrifuga</i> (3.4) M – Mi., Abu, Coc., Sap., Bor. NMP <i>Sorghum vulgare</i> – (0.5)
EG -R -T -3	Unifloral P – <i>Aspidopterys indica</i> -55.6 S – <i>Mimosa pudica</i> - 19.6 IM – <i>Terminalia arjuna</i> (12.7), <i>Mimosa hamata</i> (6) M – Soy., Sap., Abu., old., Bor., Coc. NMP – <i>Sorghum vulgare</i> – (0. 1)
EG -R -K -4	Unifloral P – <i>Aspidopterys indica</i> -51.8 S – <i>Mimosa pudica</i> - 18.9 IM – <i>Terminalia arjuna</i> (11.8), <i>Mimosa hamata</i> (7.1) , <i>Soyimida febrifuga</i> (4.5) M – Abu., Sap., old., Dil NMP- <i>Sorghum vulgare</i> – (0.3)
EG -R -D -5	Unifloral P - <i>Aspidopterys indica</i> - 50 S – <i>Mimosa pudica</i> - 21 IM – <i>Terminalia arjuna</i> (14), <i>Mimosa hamata</i> (7.8) , <i>Soyimida febrifuga</i> (3.8) M - Sap., old., Abu.
EG -R -Da -6	Unifloral P - <i>Aspidopterys indica</i> -69 S – Nil IM – <i>Mimosa pudica</i> (12.3), <i>Terminalia arjuna</i> (9.2), <i>Mimosa hamate</i> (4.2) M – Sap., Abu., Old., Soy NMP – <i>sorghum vulgare</i> (0.08)

EG-R-An-7	Unifloral P- <i>Aspidopterys indica</i> -47 S- <i>Terminalia arjuna</i> (20.7), <i>Mimosa pudica</i> (18.1), IM- <i>Mimosa hamata</i> (5.2), <i>Soymida febrifuga</i> (4.2) M - Sap., Euc., Abu., Cae.,Coc. NMP- <i>Sorghum vulgare</i> (0.2)
EG-R-L-8	Unifloral P - <i>Aspidopterys indica</i> -50 S - <i>Mimosa pudica</i> (21.7) IM- <i>Terminalia arjuna</i> (12.7), <i>Mimosa hamata</i> (7.7) M - Soy.,Sap., Old., Dil., Abu., Coc. NMP – <i>Sorghum vulgare</i> –(0.3)
EG-E-L-9	P - Nil S - <i>Terminalia arjuna</i> (24.8) IM - <i>Dillenia pentagyna</i> (13.2), <i>Syzygium cumini</i> (13.2), <i>Borassus flabellifer</i> (10.2), <i>Lannea coromandelica</i> (10.2), <i>Aegle marmelos</i> (7.4) <i>Schleichera oleosa</i> (7.2) M- Cae.,Bom.,Sap.,Alb.,Aca.,Car,Str.,Coc.,Cro, Lag.,Tri. NMP – <i>Typha angustata</i> (0.2)
EG-E-K-10	Unifloral P- <i>Borassus flabellifer</i> (60.2), S- <i>Lannea coromandelica</i> (24.6) IM- <i>Schleichera oleosa</i> (7.1), <i>Terminalia arjuna</i> (6.1) M- Syz.,Ala.,Sap.,Coc.
EG-E-S-11	Unifloral P- <i>Sapindus emarginatus</i> – 64.6 S- Euphorbiaceae type (17.7) IM- <i>Prosopis juliflora</i> (9), M- Bor., Den.,Ble.,Cae.,Euc.,Leu
EG-E- 12	Unifloral P- <i>Hygrophila auriculata</i> -74 <i>Ageratum conyzoides</i> (7.6), S- Nil <i>Ocimum basilicum</i> (4.3) <i>Prosopis juliflora</i> (4.3) IM- M- Pho.,Sap.,Sid.,Euc.,Cro, Ver. , Run.

(Abbreviations: Abu-*Abutilon indicum.*, Aca.sp-*Acacia sp.*, Ala- *Alangium salvifolium.*, Alb-*Albizia lebbeck.*, Ble-*Blepharis maderaspatensis.*, Bom-*Bombax ceiba.*, Bor-*Borassus flabellifer.*, Cae-*Caesalpinia bonduc.*, Car-*Careya arborea.*, Coc-*Cocos nucifera.*, Cro-*Croton bonplandianum.*, Den-*Dendrophthoe falcata.*, Dil-*Dellinia pentagyna.*, Euc-*Eucalyptus globulus.*, Leu-*Leucaena leucocephala.*, Mim-*Mimosa hamata.*, Old-*Oldenlandia umbellata.*, Pho-*Phoenix sylvestris.*, Run-*Rungia repens.*, Sap-*Sapindus emarginatus.*, Ses-*Sesamum indicum.*, Sid-*Sida acuta.*, Soy-*Soymida febrifuga.*, Str-*Strychnos sp.*, Syz-*Syzygium cumini.*, Ver-*Vernonia cinerea*).

Figure 1-12: Pollen spectra of honey samples studied.

Based on the frequency of distribution of pollen types in various honeys four classes were recognised. Of the 40 pollen types of nectariferous taxa, 8 pollen types (*Terminalia*

arjuna, *Sapindus emarginatus*, *Aspidopterys indica*, *Mimosa pudica*, *Abutilon indicum*, *Mimosa hamata*, *Cocos nucifera*, *Soymida febrifuga*) belonged to 'very frequent' class, 5 pollen types (*Borassus flabellifer*, *Oldenlandia umbellata*, *Eucalyptus globulus*, *Dillenia pentagyna*, *Caesalpinia bonduc*) to frequent, 6 pollen types to 'infrequent' and 21 pollen types to 'rare' classes.

Photomicrographs of some of the significant pollen types (taxa) recorded in the study are illustrated in plate-1.

Sorghum vulgare, Grass pollen, *Typha angustata* were the non-melliferous / anemophilous taxa along with a Pteridophytic spore type (sample EG.E.L-9 and EG.E.S-11) recorded in minor percentages.

DISCUSSION

The pollen analysis of twelve rock bee summer honeys has provided significant information on the bee flora of the deciduous forests of E.Godavari district of Andhra Pradesh, India. The study brought to light eleven unifloral (single source) and one multifloral honey. Majority i.e. 8 (72.7) of the unifloral honeys were derived from the nectar of *Aspidopterys indica*, a large gregarious climber of Malphigiaceae.

Borassus flabellifer, *Sapindus emarginatus* and *Hygrophila auriculata* formed the predominant pollen types in one (9.1) sample each.

The other noteworthy sources of nectar of this area include *Mimosa pudica*, *Terminalia arjuna*, *Lannea coromandela*, *Mimosa hamata*, *Eucalyptus globulus*, *Caesalpinia bonduc*, *Abutilon indicum*, *Soymida febrifuga*, *Dillenia pentagyna*, *Syzygium cumini*, *Aegle marmelos*, *Schleichera oleosa*, *Prosopis juliflora*, *Ocimum basilicum*, *Ageratum conyzoides* and *Euphorbiaceae* type.

Bee colonies obtained their food mainly from tree members. Most of the

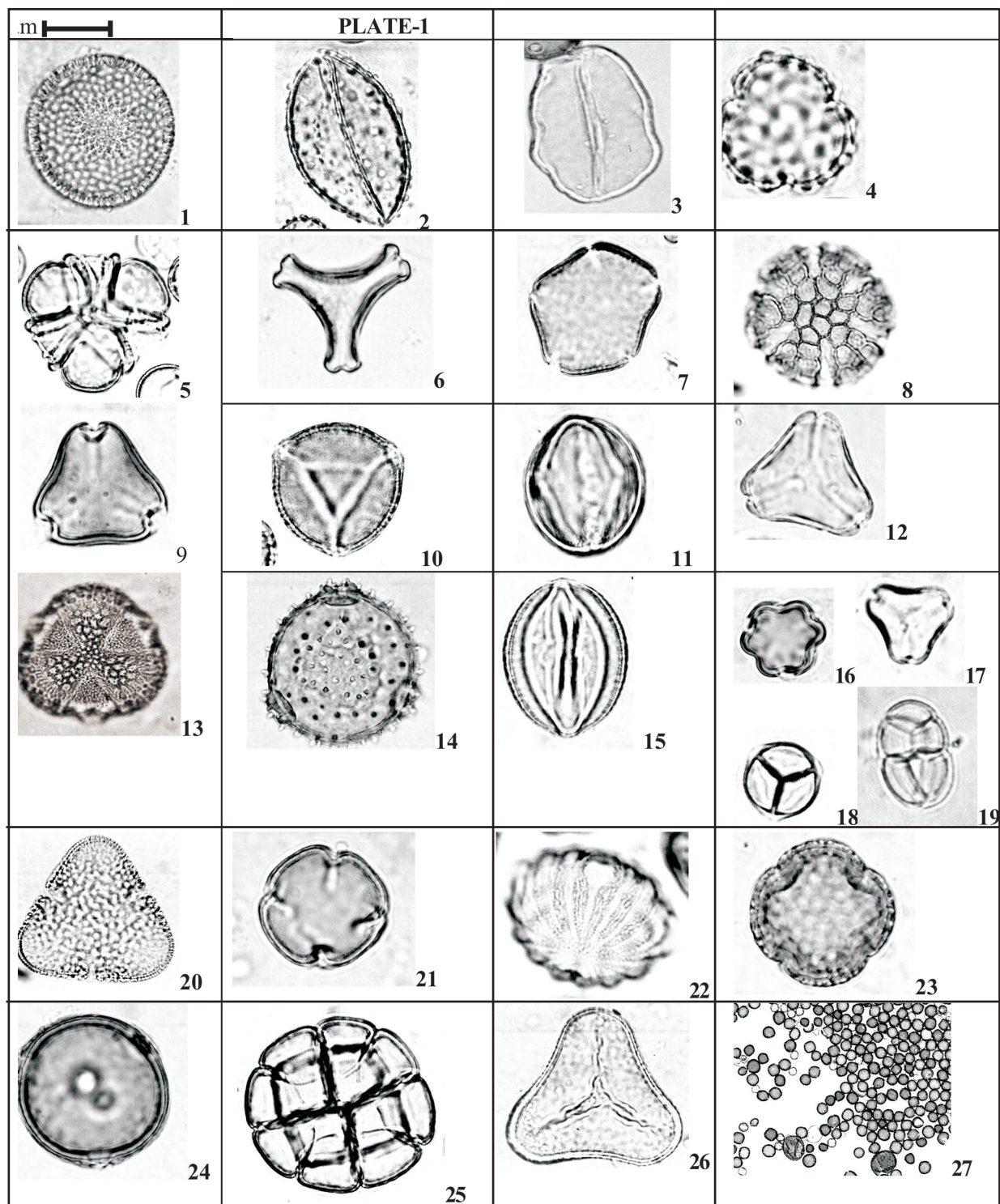


PLATE-1

1. *Croton bonplandianum*., 2. *Borassus flabellifer*., 3. *Cocos nucifera*., 4. *Dillenia pentagyna*., 5. *Careya arborea*., 6. *Dendrophthoe falcata*., 7. *Strychnos* sp., 8. *Ocimum basilicum*., 9. *Sapindus emarginatus*., 10. *Schleicheria oleosa*., 11. *Lannea coromandelica*., 12. *Eucalyptus globulus*., 13. *Caesalpinia bonduc*., 14. *Abutilon indicum*., 15. *Prosopis juliflora*., 16. *Terminalia arjuna*., 17. *Syzygium cumini*., 18. *Mimosa pudica*., 19. *Mimosa hamata*., 20. *Bombax ceiba*., 21. *Soyimida febrifuga*., 22. *Hygrophila auriculata*., 23. *Aegle marmelos*., 24. *Aspidopterys indica*., 25. *Albizia lebbeck*., 26. *Pteridophytic spore*., 27. *Aspidopterys* in unifloral condition.

arborescent taxa of these forests are in the peak of their flowering contributed fairly to the honey production.

Terminalia arjuna, *Sapindus emarginatus*, *Aspidopterys indica*, *Mimosa pudica*, *Abutilon indicum*, *Mimosa hamata*, *Cocos nucifera* and *soymida febrifuga* have encountered 'very frequently' (> 60%) in the total contingent of honeys enjoys widespread distribution in the Rajavommangi and Eleswaram forest ranges of E.Godavari district of A.P,

Earlier Ramanujam and Khatija (1992) reported *Aspidopterys indica*, as the chief nectar source for *A.dorsata* (rock bee) from the deciduous forest of W.Godavari district of Andhra Pradesh. According to Seethalakshmi (1980) *Borassus flabellifer* and *Hygrophila auriculata* are the significant bee forage plants . Further, Jhansi, and Ramanujam (1986, 1990) also highlighted *Borassus*, *Hygrophila* as reliable nectar sources for honey bees in Guntur district.

All such taxa constituting predominant pollen types in the unifloral honeys were considered as chief sources of nectar and those represented by secondary and important minor pollen types serve as useful sources of nectar.

Our study suggests that the chief / significant sources of nectar producing plants can be propagated under social forestry / afforestation programmes which would provide food to honey bees and also help in sustenance and multiplication of bee colonies leading to

copious honey production. This may also encourage commercial bee-keeping ventures involving *Apis cerana* var. *indica* and *Apis mellifera* bees by the forest and rural people.

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