SIGNIFICANCE OF *BORASSUS FLABELLIFER* L. POLLEN IN APIARY HONEYS OF GUNTUR DISTRICT, ANDHRA PRADESH

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Abstract

Pollen analysis of 15 apiary honey samples from the agricultural tracts of Tenali and Bapatla taluks of Guntur district of Andhra Pradesh has brought to light the significance of *Borassus flabellifer* as an important and reliable source of nectar for the honey bees of this region during major part of the year.

Introduction

Pollen spectra of honey samples reflect upon the prevailing local vegetation and differ with respect to the locality and season from which they are collected. In other words, the pollen suit of a honey sample is a function of floristic composition of any locality. Because of perceptible diversity of floristic composition with reference to dominance or otherwise of a taxon or a group of taxa and the occurrence of locally characteristic floral elements, the pollen content of a honey is also an expression of its geographical origin. Therefore, a critical screening of all such bee plants which provide the nectar and pollen source to honey bees of an area, helps to promote healthy growth and development of bee-keeping industry. Pollen analysis of honeys and pollen loads furnishes unequivocal information on the major and minor sources of nectar and pollen. In view of positive relationship between foraging activity of the bees and flowering period of bee plants, the nectar and pollen sources tend to differ seasonally, a proper understanding and appreciation of which could be immensely beneficial to any apicultural programme.

The present contribution, a part of more comprehensive endeavour to recognize the key bee plants of different floristic and geographical regimes of Andhra Pradesh and for demarcating all such areas of high potential for bee-keeping industry, highlights the importance of *Barassus flabellifer* (Palmyra palm), an entomophilous/amphiphilous palm, as a reliable bee plant for the major part of the year in Tenali and Bapatla taluks of Guntur district.

Material and methods

Fifteen honey samples were collected from the agricultural tracts of two taluks of Guntur, one of the coastal districts of Andhra Pradesh, during March, June (1982) and July, September and December (1989). All these samples represent extracted(apiary) honeys obtained from the beehives of *Apis cerana* var. *indica*. The taluks which provided the honey samples include-Tenali (10 samples-CHE-10 (Duggirala village), CHE-14 (Vetapalem), CHE-15 (Tenali), CHE-16 (Kazipeta), G-T-J-1a (Jagarlamudi), G-T-A-2a (Angalakuduru), G-T-N-3a (Narakoduru), G-T-K-4a (Kazipeta), G-T-M-5a (Morumpudi) and G-T-Gu-7a from Gundavarru village) and Bapatla (5 samples-CHE-11, CHE-12, CHE-13 and G-B-D-6a, all four from Dandamudi and one sample G-B-Y-10a from Yazali village). Table 1 furnishes information on the inventory of honey samples

1 ml of honey was diluted with 10 ml of water and centrifuged. The resultant sediment was treated with 5 ml of glacial acetic acid and then acetolysed (Erdtman, 1960). Three slides prepared for each sample were critically scanned for their

Table 1—Inventory of apiary honeys from Tenali and Bapatila taluks of Guntur District

Sample No.	Mandal	Locality	Date of collection
CHE-10	Tenali	Duggirala	June, 1982
CHE-11	Bapatla	Dandamudi	June, 1982
CHE-12	Bapatla	Dandamudi	June, 1982
CHE-13	Bapatla	Dandamudi	June, 1982
CHE-14	Tenali	Vetapalem	June, 1982
CHE-15	Tenali	Tenali	March, 1982
CHE-16	Tenali	Kazipeta	March, 1982
G-T-J-1a	Tenali	Jagarlamudi	September, 1989
G-T-A-2a	Tenali	Angalakuduru	September, 1989
G-T-N-3a	Tenali	Narakoduru	September, 1989
G-T-K-4a	Tenali	Kazipeta	September, 1989
G-T-M-5a	Tenali	Morumpudi	July, 1989
G-B-D-6a	Bapatla	Dandamudi	July, 1989
G-T-Gu-7a	Tenali	Gundavarru	December, 1989
G-B-Y-10a	Bapatla	Yazali	December, 1989

pollen contents. The pollen type recorded were identified with the help of reference slide collection and relevant literature.

For determining the frequency classes, 300 pollen grains were counted and the recovered pollen types were placed under four categories (Louveaux *et al.*, 1978), viz., predominant pollen type (>45%), secondary pollen types (16-45%), important minor pollen types (3-15%) and minor pollen types (<3%).

Results

Pollen analysis of all the fifteen honey samples brought to light the presence of *Borassus flabellifer*, the percentage of which ranged from 3.3 (G-T-N-3a) to 88.7% (CHE-14). *Borassus flabellifer* constitutes the predominant pollen type in two samples (CHE-14 and CHE-15) with a very high percentage of 88.7 and 84% which may be designated as almost pure *Borassus* honeys. In the remaining samples, it is represented either as secondary or important minor pollen type

The honey sample CHE-15 and CHE-16 from Tenali and Kazipeta respectively represent March honeys. *Borassus flabellifer* constitutes the predominant pollen type (84%) in CHE-15, while it represents the secondary pollen type (24%) in CHE-16. The significant pollen types associated with *Borassus* pollen in these honeys (as secondary and important minor) were *Hygrophila* sp., *Pongamia pinnata*, *Citrus limon*, *Brassica nigra*, *Tridax procumbens* and *Sphaeranthus indicus*.

The honey samples CHE-10 (Duggirala), CHE-11, CHE-12, CHE-13 (Dandamudi) and CHE-14 (Vetapalem) represent June honeys. The three Dandamudi samples showed *Borassus* as the secondary pollen type (16.5, 27.6 and 36.3%), while the Vetapalem honey had *Borassus* as the predominant pollen type (88.7%). In CHE-10 obtained from Duggirala, however, *Borassus* represents the important minor pollen type (12.5%). *Hygrophila* sp. constitutes the predominant pollen type (47.5%) in one of the Dandamudi samples (CHE-11). The other important sources of nectar during June in Tenali and Bapatla taluks (as secondary and important minor) include *Phoenix sylvestris*, *Phyla nodiflora*, *Crotalaria juncea*, *Cucumis* sp., *Momordica charantia*, *Delonix regia*, *Cassia* sp., *Vitex negundo*, *Thespesia populnea*, *Mangifera indica*, *Phaseolus* sp., *Coccinia indica*, *Cocos nucifera* and *Morinda tinctoria*.

In the two honey samples G-T-M-5a (Mornmpudi) and G-B-D-6a (Dandamudi) extracted during July, *Borassus* formed the important minor (7.5%) and secondary

pollen type (21 7%) respectively. The other significant pollen types in July honeys (as secondary and important minor) include *Momordica charantia*, *Cucumis*, sp., *Phoenix sylvestries*, *Brassica nigra*, *Cleome gynondra*, *Cocos nucifera*, *Citrus limon*, *Capsicum frutescens*, *Phyla nodiflora* and *Mangifera indica*.

The honey samples (4 samples) from Jagarlamudi (G-T-J-la), Angalakuduru (G-T-A-2a), Narakoduru (G-T-N-3a) and Kazipeta (G-T-K-4a) villages, obtained during September showed *Borassus* as the important minor pollen type, its percentage ranging from 3.3 to 7.5 percent. In the samples G-T-A-2a and G-T-N-3a *Mimosa pudica* formed the predominant pollen type (53.6 and 49 6%). The associated pollen types (secondary and important minor) were *Hygrophila* sp., *Phoenix sylvestris*, Urticaceae, *Mangifera indica*, *Coriandrum sativum*, *Ziziphus mauritiana*, *Sopubia delphinifolia*, *Cocos nucifera*, *Brassica nigra* and *Capsicum frutescens*.

Borassus again is an important minor pollen (3.4 and 4.5%) in the two samples (G-T-Gu-7a from Gundavarru and G-B-Y-10a from Yazali) obtained during December. *Sapindus emarginatus* (70.2%) and *Prosopis juliflora* (58.2%) constitute the predominant pollen types of these honeys respectively. There are no secondary pollen types in these honeys and *Phoenix sylvestris* and *Capsicum frutescens* represent the important minor pollen types of these samples.

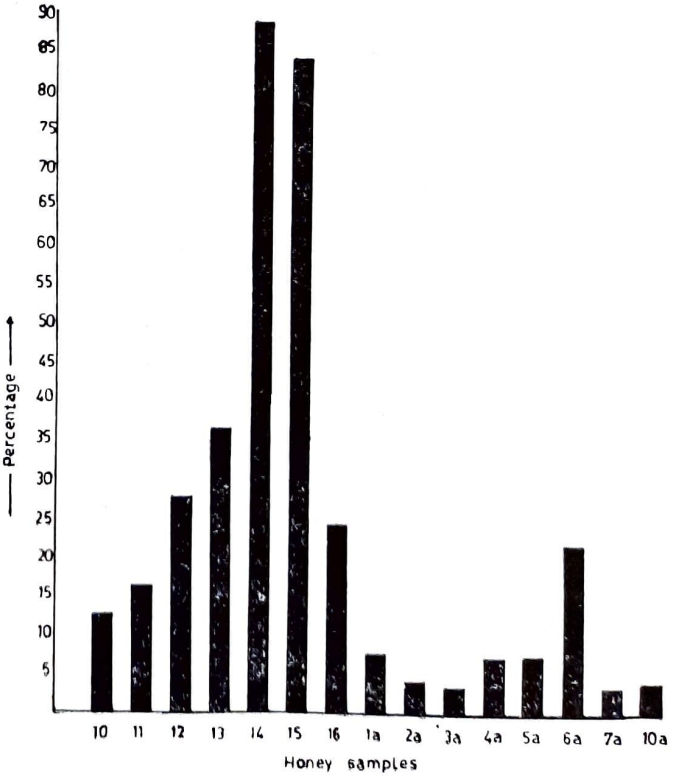
Information pertaining to the numerical status (frequency) of *Borassus* pollen and its important associates in each sample is incorporated in Table 2. The frequency of *Borassus* pollen in each honey sample is represented in the form of histogram (Text-fig. 1). Plate 1 provides the photomicrographs of the significant pollen type encountes in these honeys.

Discussion

The above qualitative and quantitative study of the pollen contents of fifteen honey samples from Tenali and Bapatla taluks of Guntur district revealed the importance of *Borassus flabellifer* as a reliable nectar source for the bees during major part of the year. *Borassus* pollen constitutes the predominant pollen type in two samples of Tenali taluks obtained in March and June. In another March sample obtained from a different locality (Kazipeta) of this mandal, however, it represents only secondary pollen type. *Borassus* generally constitutes secondary pollen type in the samples collected during June and July. In September and December samples, it still continues to be represented, but only as important minor pollen type.

In most of the available records March-April is mentioned as the flowering period of *Borassus flabellifer*. Tilak (1989), however, stated that it flowers throughout the year. The pollen analysis of apiary honey indicates that *Borassus* flowers during major part of the year. Seethalakshmi and Percy (1979) recorded pollen loads of *Borassus flabellifer* from Kuzhuthurai in Tamilnadu from February 1975 to January 1977 and rightly suggested the importance of this plant as pollen source throughout the year. They further highlighted flushes in the blooming of this palm as evidenced by higher frequency of pollen loads in certain months. Moses *et. al.* (1987) from a detailed study of 1240 pollen loads from Vijayarai (West Godavari District of Andhra Pradesh) recorded the occurrence of pollen loads of this palm in January, February, March, April, May, June, August, October and November.

Seethalakshmi (1980) in her study of two honey samples collected in April from Tenali recognised the pollen of *Borassus flabe-*

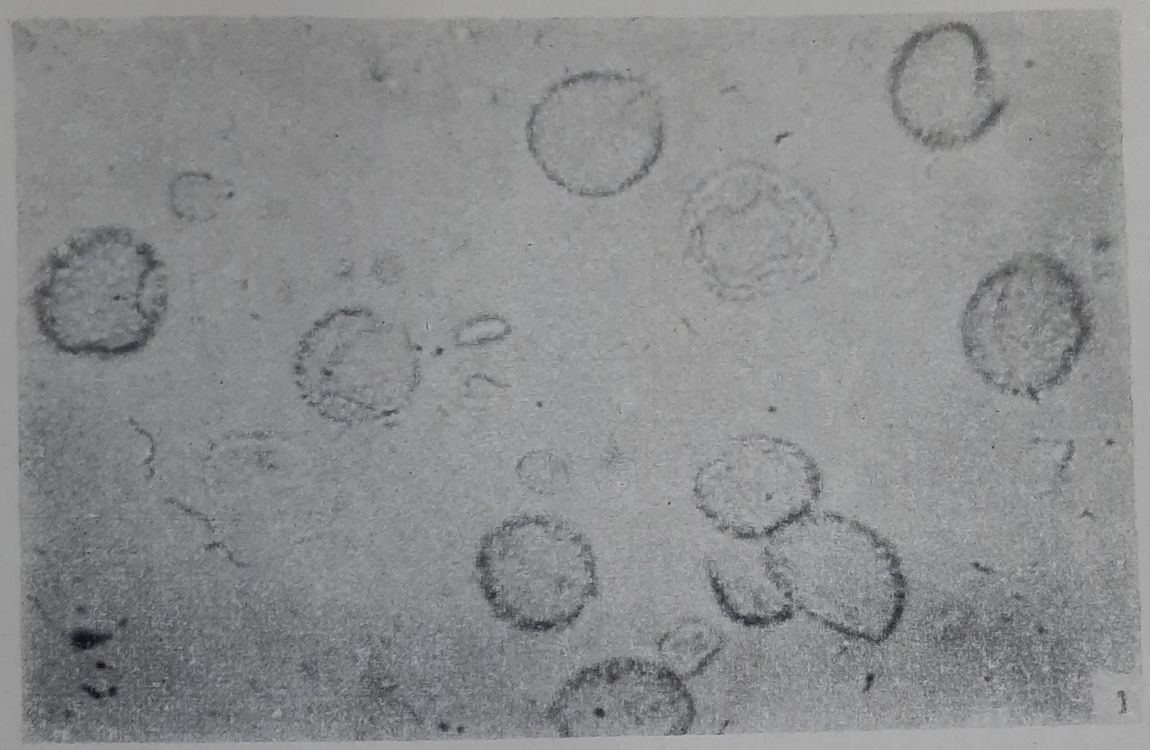


Text-figure 1—Histogram showing frequency of *Borassus* pollen in honey samples studied.

Table 2—Frequency of Barassus pollen and its associates (information provided upto important minor types)

Sample	*Borassus* pollen (%)	Associates of *Borassus* pollen (%)
CHE-10	I (12.5)	S-*Phyla nodiflora* (26.7) *Phoenix sylvestris* (20.6) I-*Delonix regia* (9), *Vitex negundo* (9), *Thespesia populnea* (6.8), *Cassia* sp. (3.8)
CHE-11	S (16.5)	P-*Hygrophila* sp. (47.5) I-*Phyla nodiflora* (12.5), *Mangifera indica* (7.5), *Phaseolus* sp. (7.5), *Coccinia indica* (5.4)
CHE-12	S (27.6)	S-*Crotalaria juncea* (35.2), *Phyla nodiflora* (17.6) I-*Hygrophila* sp. (8.8), *Cocos nucifera* (4), *Cocumis* sp. (4)
CHE-13	S (36.3)	S-*Crotalaria juncea* (21), *Cucumis* sp. (17.7), *Momordica charantia* (16.33) I-*Phyla nodiflora* (3)
CHE-14	P (88.7)	I-*Morinda tinctoria* (3.75)
CHE-15	P (84)	I-*Pongamia pinnata* (8), *Hygrophila* sp. (4.1), *Citrus limon* (3)
CHE-16	S (24)	S-*Hygrophila* sp. (28) I-*Citrus limon* (13), *Brassica nigra* (6), *Tridax procumbens* (5.3), *Sphaeranthus indicus* (4.7)
G-T-J-1a	I (7.5)	S-*Hygrophila* sp. (20.9), *Phoenix sylvestris* (23.4) I-*Sopubia delphinifolia* (15), *Mangifera indica* (6.5), *Ziziphus mauritiana* (6.1), *Coriandrum sativum* (4.5)
G-T-A-2a	I (4)	P-*Mimosa pudica* (53.6) I-*Urticaceae* (15), *Cocos nucifera* (13.3), *Sopubia delphinifolia* (3.6)
G-T-N-3a	I (3.3)	P-*Mimosa pudica* (49.6) *Urticaceae* (20.2) I-*Sopubia delphinifolia* (10), *Cocos nucifera* (4.5)
G-T-K-4a	I (7)	S-*Hygrophila sp.* (37.6) I-*Brassica nigra* (15), *Phoenix sylvestris* (13.4), *Ziziphus mauritiana* (4.3) *Coriandrum sativum* (3.3), *Capsicum frutescens* (3)
G-T-M-5a	I (7.5)	S-*Phoenix sylvestris* (34.6) I-*Cleome gynandra* (11), *Cocos nucifera* (6.3), *Capsicum frutescens* (8.6), *Citrus limon* (8.6), *Phyla nodiflora* (6.5), *Brassica nigra* (4.6)
G-B-D-6a	S (21.7)	S-*Cucumis* sp. (34.4), *Momordica charantia* (27) I-*Cocos nucifera* (4), *Mangifera indica* (3.3)
G-T-Gu-7a	I (3.4)	P-*Sapindus emarginatus* (70.2) I-*Phoenix sylvestris* (4.6)
G-B-Y-10a	I (4.5)	P-*Prosopis juliflora* (58.2) I-*Phoenix sylvestris* (15), *Sapindus emarginatus* (6.5), *Capsicum frutescens* (4.5)

P—Predominant pollen type (>45%), **S**—Secondary pollen types (16–45%), **I**—Important minor pollen types (3-15%).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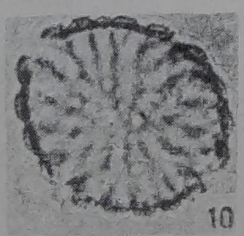
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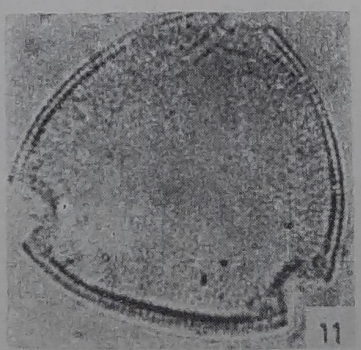
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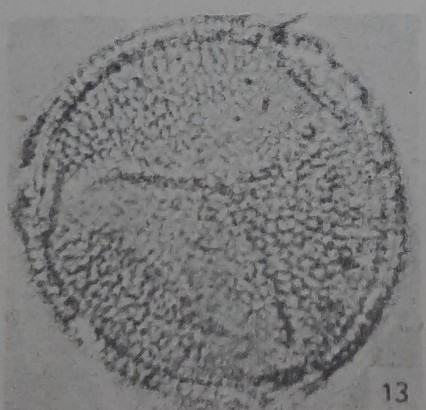
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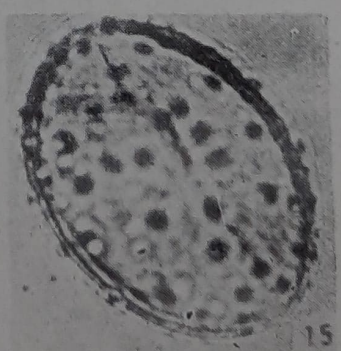
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llifer as secondary and important minor pollen type, associated with *Phyla nodiflora* and *Hygrophila* sp. She further mentioned that the bee-keepers of this area consider *Borassus* as a nectar source. According to Dr. M. C. Suryanarayana (Personal communication) of the Central Bee Research and Training Institute, Pune, bee-keepers in Guntur and Krishna districts mainly get honey from this source. Moses *et al.* (1987) commented upon *Borassus* as not only an important minor source of pollen but also an important source of nectar at Vijayarai, West Godavari district. Agwu and Akanbi (1985) have shown that the African oil palm, *Elaeis guinensis* as a major nectar source for the honey bees in certain regions of Nigeria. Further, it is also known that a number of other palms, viz., *Cocos*, *Phoenix*, *Roystonea*, etc., also constitute fairly important source of nectar (Eva Crane *et al.*, 1984).

The present study thus indicates in no uncertain manner that *Borassus flabellifer*, seen extensively in the agricultural tracts of the Tenali and Baptla taluks of Guntur district, constitutes an important and reliable nectar source for the bees during major part of the year. The earlier work of Seethalakshmi and Percy (1979) and Moses *et al.* (1987) highlighted the significance of this palm as an important pollen source to the honey bees almost throughout the year. *Borassus*, thus can now be considered as an important source of both pollen and nectar for the honey bees. In view of its wide spread occurrence, often in great profusion in the coastal plains of Andhra Pradesh, the bee-keepers of this region may profitably exploit this palm in their commercial honey producing ventures.

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Explanation of plate

Plate I

(unless otherwise mentioned all figures × 500)

1. Vetapalem honey (CHE-14) showing *Borassus flabellifer* as predominant pollen type (x 250).
2. *Mimosa pudica*
3. *Phoenix sylvestris*
4. *Crotalaria juncea*
5. *Prosopis juliflora*
6. *Phyla nodiflora*
7. *Sapindus emarginatus*
8. *Capsicum frutescens*
9. *Brassica nigra*
10. *Hygrophila* sp.
11. *Cucumis* sp.
12. *Cocos nucifera*
13. *Momordica charantia*

14-15. *Borassus flabellifer*