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RESEARCH ARTICLE

MELISSOPALYNOLOGICAL STUDIES ON WINTER HONEYS FROM BRAMHAPURITAHSIL, CHANDRAPUR DISTRICT (MAHARASHTRA STATE), INDIA

[1,*]Laxmikant N. Borkar and [2]Devendra M. Mate

[1]Department of Botany S.S. Jaiswal Arts, Commerce & Science College Arjuni/mor Dist. - Gondia
[2]Department of Botany Nutan adarsh Arts, Comm. & Smt M. H. Wegad Science College Umrer, Dist. – Nagpur

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Corresponding author:
Laxmikant N. Borkar

ABSTRACT

The paper incorporates a qualitative and quantitative study of pollen contents in four squeezed honey samples collected from Bramhapuri tahsil of Chandrapur district. *Cajanus cajan* represents the predominant pollen type (49%) in one sample are designated as *Cajanus* honey. The other significant pollen types recorded include *Celosia argentea*, *Lathyrus sativus*, *Coriandrum sativum*, *Prosopis juliflora*, *Hyptis suaveolens*, *Capparis grandis*, *Cajanus cajan*, *Cleome gyanandra*, *Tridax procumbence*, *Capsicum annuum.* The pollen counts ranged from 85,000/g to 125500/g. The data reflects the floral situation of the place were particular honey was produced and the identification of geographical origin based on the presence of a combination of pollen types of that particular area.

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INTRODUCTION

Melittopalynology is an applied branch of palynology dealing with the study of pollen grains in honey samples and its application in Apiculture. Plant produces nectar and pollen both of which are avidly sought after by the bees to provide nutrition to the colony. Melittopalynology is concerned with the identification of pollen in honeys. Evaluation of plants for their utility as sources of bee forage provides the information needed to assess the potential for beekeeping in an area. Melittopalynological studies are thus helpful in bee management and in promoting the beekeeping development. Laboratory studies using Melittopaloynological methods have been made to evaluate sources of pollen and nectar for honey bees in different parts of the country namely Maharashtra (Laxmikant Borkar and Devendra Mate,2017-18, Bhusari *et al*., 2005; Phadke, 1962; Kumar and Jagtap, 1988), Andra Pradesh (Ramanujam and Khatija, 1991, Kalpana and Ramanujam, 1991, Moses,1987, Karnataka (Yoganarasimhan, 1982; Agashe and Ranjaswami, 1997; Sheshagri, 1985; Bhargava *et al.*, 2009), Lucknow (Suryanarayana, 1976) and Indian honeys (Sen and Banarjee, 1956; Nair, 1964; Seethalakshmi, 1993). Present investigation incorporates a quanlitative and quantitative pollen analysis of five honey sample from forest area of Bramhapuri tahsil of Chandrapur District. In order to identify the chief bee foraging plants recognize the uni and multifloral honeys and identify areas suitable for bee-keeping industry in this area. It is further investigated that a study of this nature would also highlight the geographical source of the honey samples.

MATERIALS AND METHODS

Four honey samples viz., CHN-BRA-MEN, CHN-BRA-GAN, CHN-BRA-BHU, CHN-BRA-KIR, were collected during the period Dec 2011 to Feb 2012 from Mendaki, Ganeshpur, Bhuj, Kirmati respectively. All the samples represent squeezed honey collected from the natural *Apis dorsata* hives.

Table 1. Pollen frequency class in *Apis dorsata* honey

Sample No.	Date of Collection	Type of Honey	Absolute pollen counts (APC) / g	HDE/P	Pollen Type
CHN-BRA-MEN	20-12-2011	Multifloral	85,000/g	0.05	P –Nil S - *Cajanus cajan*(18.66) *Lathyrus sativus*(16.33) *Celosia argentea*(16.16) I – *Capsicum annuum*(12.83) *Hyptis suaveolens*(7.66) *Capparis grandis*(7.16) *Prosopis juliflora* , *Tridax procumbens*(each 3.66) *Cleome gynandra*(3.33) M –Leu, Bl(each 1.5), Mi(1), Cle(0.83), Do (0.66) ,Bi(0.5) NMP – *Sorghum vulgare*(0.08)
CHN-BRA-GAN	30-12-2011	Unifloral	115,000/g	0.01	P – *Cajanus cajan*(49) S – *Celosia argentea*(17) I – *Lathyrus sativus*(14.16) *Capsicum annuum*(9) *Hyptis suaveolens*(8.06) M – Tri(1.5), Ci, Ca(each 0.5), Ps(0.33) NMP –Nil
CHN-BRA-BHU	25-02-2012	Multifloral	1255,000/g	0.01	P –Nil S - *Capsicum annuum*(31) *Cajanus cajan*(20.16) I – *Hyptis suaveolens*(8.66) *Tridax procumbens*(6.33) *Capparis grandis*(5) *Cleome gynandra*(4.5) *Celosia argentea*(4) *Lathyrus sativus*(13.8) M – Cart(2.5), Do, Ps, Bl(each 1.33), Ci(0.83) NMP – *Sorghum vulgare*(6.41) *Holoptelea integrifolia*(1.91)
CHN-BRA-KIR	30-02-2012	Mutlifloral	916,000/g	0.02	P –Nil S - *Coriandrum sativum*(27.08) *Capsicum annuum*(18.83) *Cajanus cajan*(17) I – *Celosia argentea*(13.16) *Lathyrus sativus*(10.6) *Cleome gynandra*(4.83) *Capparis grandis*(4.66) M –Bl(2.33), Mo(0.66) NMP –Nil

The squeezing (pressing) of the honey combs was carried out under personal supervision and only under personal supervision and only honey bearing portion of the comb was used for this purpose. One ml of the honey sample was dissolved in 10 ml of distilled water & centrifuged. The sediment obtained was treated with 5 ml glacial acetic acid. The acetic acid was decanted and the material was subjected to Acelolysis (Erdman, 1960) for analysing the pollen content in honeys qualitatively & quantitatively , three pollen slides were prepared for each sample. The recorded pollen types were identified with the help of reference slide collection & relevant literature for quantification of pollen types recorded, a total of 300 pollen grains were counted at random from the three palyno slides prepared for each samples. Based on their frequencies, the pollen types encountered were placed under the pollen frequency classes recommended by the international commission for bee Botany (1978) viz., predominant pollen type(>45%), secondary pollen type(16-45%), important minor pollen types(3-15%),and minor pollen types(<3%). Non-melliferous (anemophilous) pollen types were excluded while determine the frequencies of melliferous pollen types (ICBB 1978).

The absolute pollen counts of each sample was determined in accordance with the method recommended by Suryanarayana et al. (1981). Unacetolysed samples of honey were examined for the study of honeydew elements (fungal spores, hyphal shreads and algal filaments).

RESULTS AND DISCUSSION

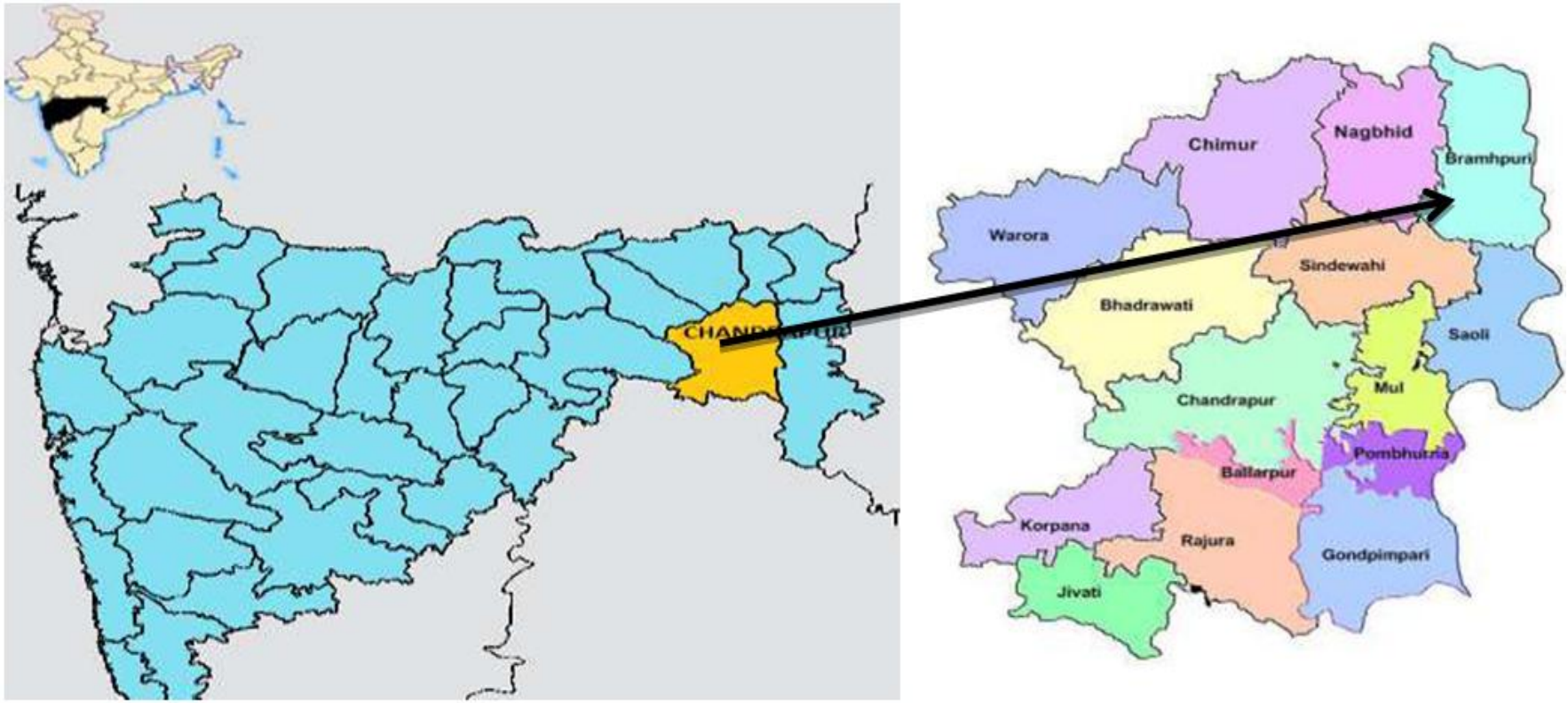
Of the 4 honey sample collected from Bramhapuri tahsil (CHN-BRA-MEN) *Cajanus cajan* (49%) represented the predominant pollen type in one sample while(CHN-BRA-GAN), while 3 are multifloral CHN-BRA-MEN, CHN-BRA-BHU, CHN-BRA-KIR. The other significant pollen typesrecorded includes (secondary to minor pollen) *Celosia argentea, Lathyrus sativus, Coriandrum sativum, Prosopis juliflora, Hyptis suaveolens, Capparis grandis, Cajanus cajan, Cleome gyanandra, Tridax procumbence, Capsicum annuum.*
All together 21 pollen types (19 melliferous and 2 non-melliferous taxa)referable to 15 families have been recorded from these samples (Photoplates). The sample (CHN-BRA-MEN) showed the maximum number of pollen type (16) and the sample(CHN-BRA-GAN, CHN-BRA-KIR), the minimum number (9) each.

Table 2. Showing pollen morphology of Melliferous taxa

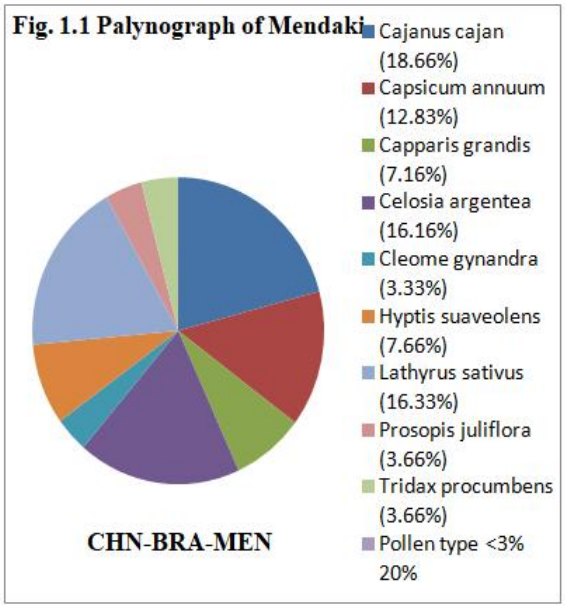
Sr. No.	Pollen types	Pollen size, shape and symmetry	Aperture pattern	Pollen wall (Sporoderm) Structure and sculpture
01	*Bidens pilosa*Linn.	25-29 µm Amb spheroidal; 23-25× 27-30 µm, sub-oblate; Radially symmetrical	Tricolporate, colpi long, ends tapering, tips acute, ora lalongate	Exine 1.5 µm thick,tectate, surface echinate, spines 6.8 µm long, base 2µm broad
02	Blumea sp.	21-24 µm, Amb spheroidal, isopolar, Radially symmetrical	Tricolprate, colpi long	Exine 3 µm thick, surface echinate, spines 5-6 µm long, 4 spines in the inter apertural region interspinal area psilate
03	Cajanus cajan (Linn.) millsp.	35-37 µm Amb rounded triangular ; 32-34× 35-39 µm, oblate spheroidal; radially symmetrical	Tricolporate, colpi long, ends tapering, tips acute, ora circular	Exine 3.1 µm thick, sub tectate, surface reticulate, heterobrochate, meshes smaller near the apertural regions and larger elsewhere, lumina hexa to pentagonal, psilate, muri simplibaculate
04	Capparis grandis Linn.	10-12 µm , Amb spheroidal; 14-16 ×9-12 µm prolate to subprolate; Radially symmetrical	Tricolporate, colpi linear to narrowly elliptic, ends tapering, tips acute, ora faint lalongate	Exine 1 µm thick, tectate, surface faintly granular to almost psilate
05	Capsicum annuum Linn.	29-34 µm, Amb spheroidal; 29-35× 26-30 µm, subprolate; radially symmetrical	Tricolporate , colpi constricted at oral region, ends tapering, tips acute, ora prominently lalongate	Exine 1.5 µm thick, tectate, surface faintly granular to almost psilate
06	Carthamus tinctorius Linn.	59-65 µm, Amb spheroidal: 58-62× 66-73 µm, subprolate, radially symmetrical	Tricolporate , colpi with tapering ends, ora lalongate	Exine (spinoid processes included) about 8 µm thick at poles, 10 µm at equator tectate, tectum prominently columellate, columella simple or branched, sharply undulating with supratectal solid, pointed, robust sinule like processess
07	*Citrus* sp.	27-29 µm, Amb squarish, 26-30 ×25-27 µm, prolate spheroidal radially symmetrical	Tetracolporate, colpi linear, tips acute, ora lalongate	Exine 2 µm thick subtectate, surface Reticulate. Heterobrochate, meshes smaller near the apertural regions and larger elsewhere, lumina hexa to pentagonal or irregular, psilate, muri simpli to locally duplibaculate
08	Cleome gynadra Linn	19-21 µm, Amb spheroidal, 18-22 ×14-16 µm, prolate spheroidal; radially symmetrical	Tricolporate, colpi with tapering ends, ora faint, lalongate	Exine 1 µm thick, sub-tectate, surface finely reticulate, homobrochate, lumina polygonal, smooth, muri simplibaculate
09	Celosia argentea Linn	30-35 µm spheroidal radially symmetrical	Pantoporate, pore No. 15-20, circular. Diam; 4-5 µm, pore membrance flecked with granules, interporal distance 8-11 µm	Exine 2 µm thick, tectate, interporal space coarsely granular
10	*Clerodendrum* sp.	43-48 µm , Amb spheroidal, 41-44 ×37-40 µm , prolate spheroidal ; Radially symmetrical	Tricolporate, colpi fairly long, tips acute, colpal margins broken	Exine 1.5 µm thick (excluding spinules), tectate surface spinulate, spinules 0.6-1 µm long, interspinular space finely granular
11	Coriandrum sativum Linn.	23-28 µm, Amb seenonly occasionally , rounded triangular; 35-28× 15-16 µm perprolate constricated of the equator, Radially symmetrical	Tricolporate, colpi long, narrow, ora lalongate to circular	Exine 1.5-2 µm thick at poles and 2.5 – 3.5 µm thick at equator, subtectate, surface finely reticulate
12	Dodonaea viscosa(Linn). Jacq.	29-32 µm, Amb subtriangular to rounded with slightly projecting obtuse angles: 30-33 × 26-29 µm prolate spheroidal, Radially symmetrical	Tricolporate, colpi long and narrow, almost reaching the poles, ora lalongate with Plate Fig.heavy endexinous thickening on the polar sides.	Exine 2.5 µm thick, subtectate, surface faintly microreticulate
13	Hyptis suaveolens (Linn.) Poit.	35-39 µm, Amb spheroidal; 32-35× 36-39 µm, oblate spheroidal ; Radially symmetrical	Hexacolpate, colpi long, tips acute	Exine 2.5 µm thick, subtectate, surface reticulate (at places retipilate), reticulum homobrochate, lumina polygonal to circular with few free pila heads, muri simplibaculate.
14	Lathyrus sativus Linn.	42 × 31.5 µm, prolate to perprolate , Radially symmetrical	Tricolporate, colpi long, ends tapering, ora circular to slightly lalongate	Exine 1.5 µm thick, subtectate, surface reticulate.
15	*Leucaena leucocephala* (Lam.) de Wit	52-59 µm, Amb spheroidal : 47-49×51-58 µm, sub oblate: Radially symmetical	Tricolporate colpilong, tips acute, ora lalongate	Exine 4 µm thick, subtectate surface microreticulate, homobrochate
16	*Mimosa* sp.	Pollen grains in polyads rarely in tetrads, 4-6 celled, 18-20 ×12-14 µm, elliptic; monad with hemispherical outer and conical inner portions; Radially symmetrical	Apertures faint to indistinct	Exine 0.5 µm thick, tectate, surface psilate
17	Prosopis juliflora (Sw.) DC	36-39 µm, Amb rounded triangular; 38-42× 30-35 µm, prolate to subprolate; Radially symmetrical	Tricolllporate, occasionally syncolpate, colpi tapering towards poles, tips acute, ora lalongate	Exine 3.2 µm thick, tectate surface faintly reticulate
18	Psidium guajava Linn.	24-25 µm, Amb subtriangular; 13-16× 26-28 µm, oblate; Radially symmetrical	Tricolporate, syncolpate, parasyncolpate, ora lalongate	Exine 1.5 µm thick , tectate surface granular to pailate
19	Tridax procumbens Linn.	31-38 µm, Amb rounded triangular to squarish; 30-35x 32-38 µm, oblate spheroidal; Radially symmetrical	Tri to tetra colporate, colpi linear, sharply tapering, ora faint, circular	Exine 5 µm (without spines) thick, tectate, surface echinate, spines 6 µm long, 2.5 µm in diam, at base

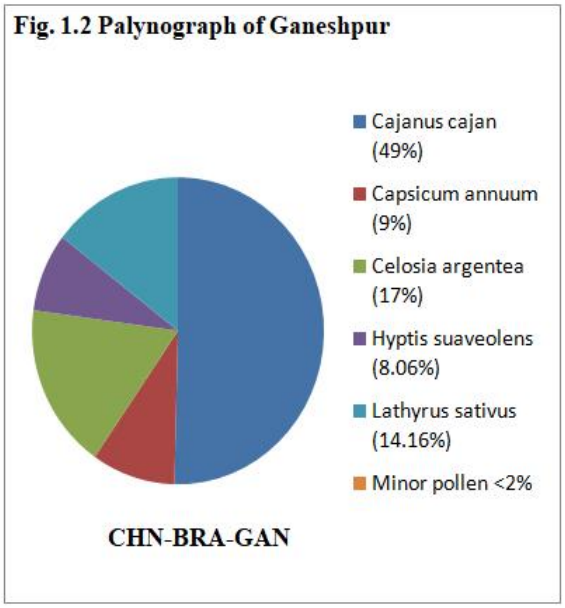
Table 2. Showing pollen morphology of Non-melliferous taxa

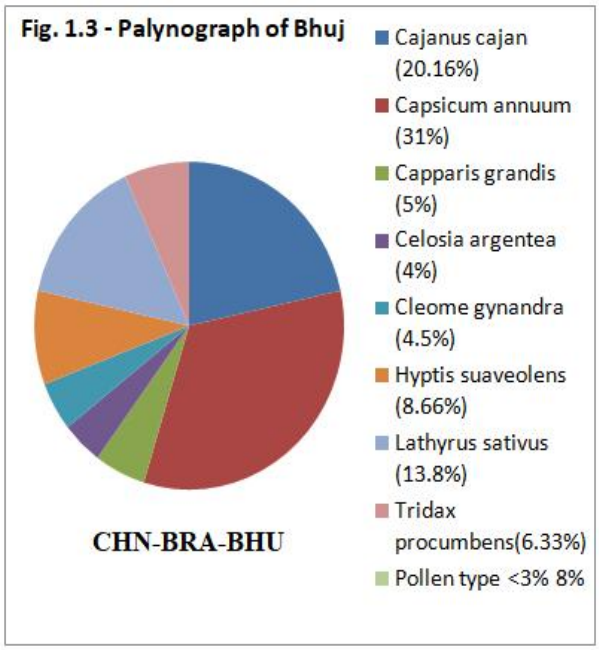
Sr. No.	Pollen types	Pollen size, shape and symmetry	Aperture pattern	Pollen wall (Sporoderm) Structure and sculpture
01	Holoptelea integrifolia (Roxb.) Planch	26-28 µm, Amb spheroidal to slightly angular; Radially symmetrical	Tetra to hexaporate, generally hexaporate pores circular with distinct margins, 2-3 µm in diam	Exine 1.5 µm thick, subtectate, surface faintly microreticulate
02	Sorghum vulagare Pers.	51-55 µm, spheroidal; Radially symmetrical	Monoporate, pore circular provided with annulus, pore diam with annulus 4.1 µm without annulus 3.3 µm	Exine 1 µm thick, tectate , surface faintly granular to almost psilate

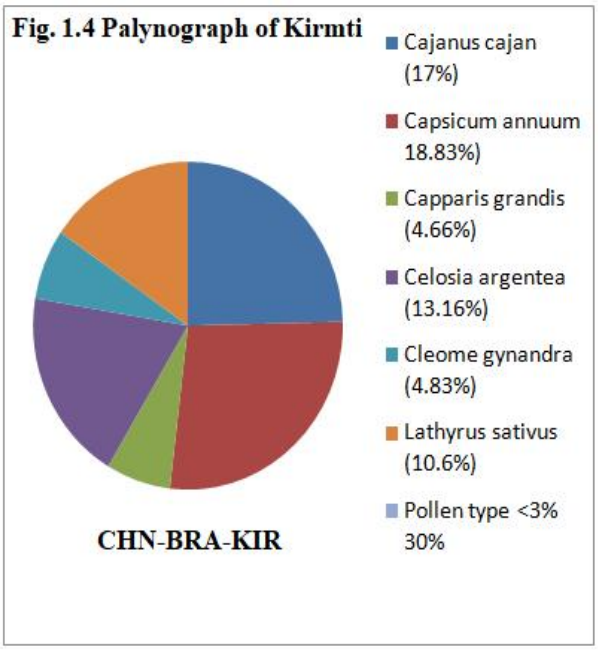


Pie charts showing pollen spectra of *Apis dorsata* honeys samples









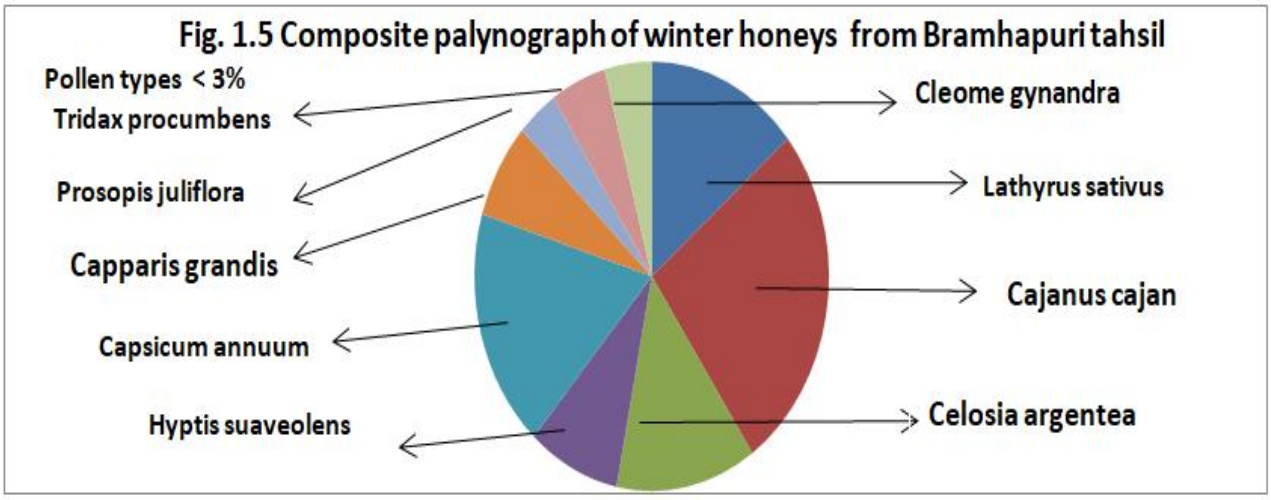
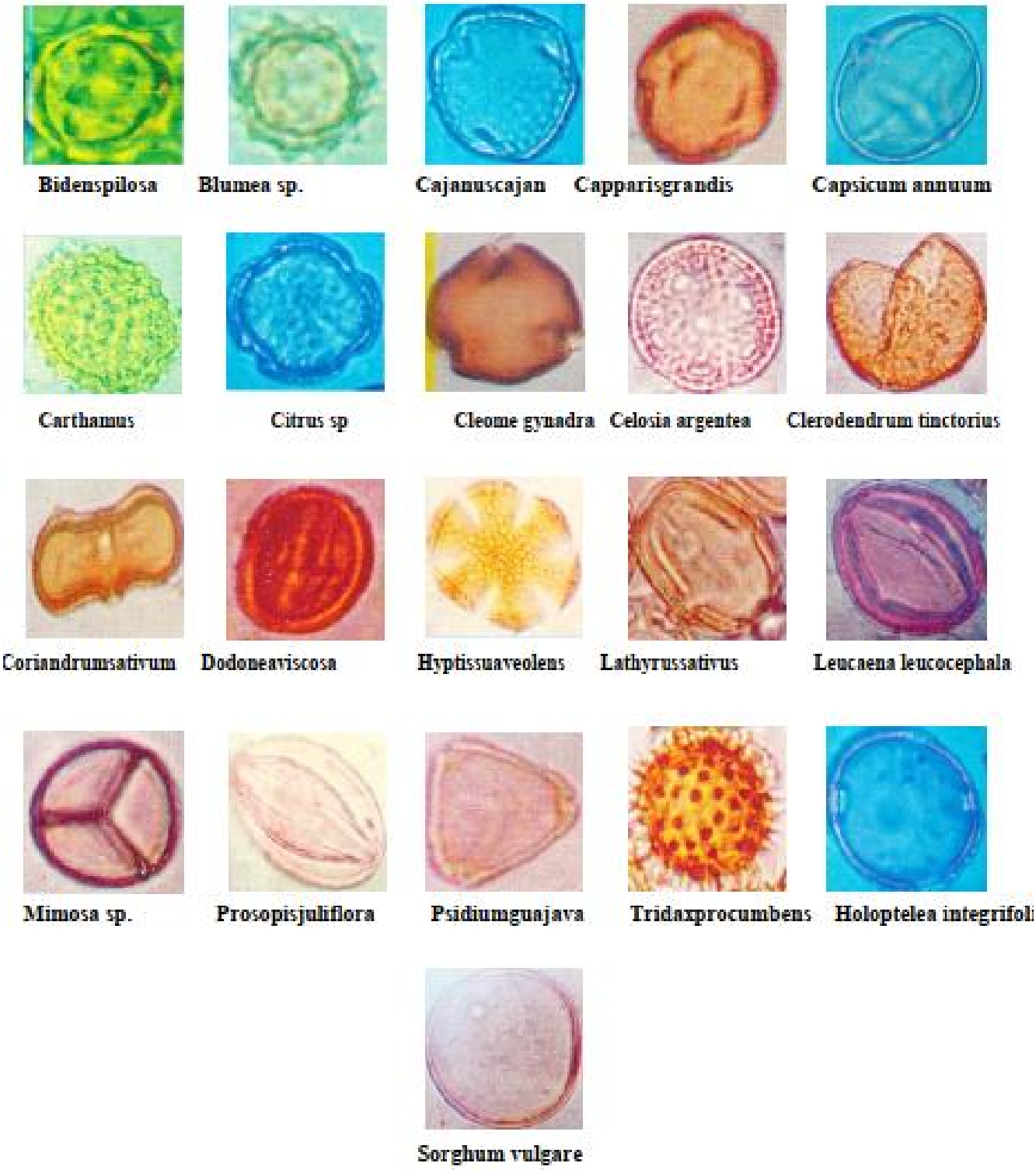


Plate Microscopic photograph of pollen grains found in honey sample



The absolute pollen counts ranged from 85000/g to 1255000/g and the HDE/P ratio ranged from 0.01 to 0.05. The details of the pollen analysis of the 4 honey sample (melliferous / non-melliferous) are represented in table 2. The distinguishing morphological feature of the pollen types encountered in the present study are given below. All together 21 pollen types (19 melliferous and 2 non-melliferous taxa) referable to 15 families have been recorded from these samples (Photoplate). The sample (CHN-BRA-MEN) showed the maximum number of pollen type (16) and the sample (CHN-BRA-GAN and CHN-BRA-KIR), the minimum number (9 each). The absolute pollen counts ranged from 85,000/g to 1,255,000/g and the HDE/P ratio ranged from 0.01 to 0.05 (Table 1). The details of the pollen analysis of the 4 honey samples (melliferous/non-melliferous) are represented in table1. Similarly individual palynograph (Pollen spectra) of each honey sample and composite palynograph was also given to show the pollen

contents of the samples of Bramhapuritehsil (Fig. 1.1-1.5). The distinguishing morphological features of the pollen types encountered in the present study are given below. The bee plants of Bramhapuri tahsil are referable to 3 categories:

- **Crop plants**: *Cajanus cajan, Lathyrus sativus, Cariandrum sativus, Capsicum annuum* and *Sorghum vulgare.*
- **Arborescent taxa/shrub:***Pisidium guajava, Dodonea viscosa, Capparis grandis, Clerodendrum sp, Leucaenaea leucocephala, Mimosa sp., Citrus sp., Prosopis juliflora.*
- **Herbaceous weeds:***Celosia argentea, Hyptis suaveolens, Carthamous tincterius, Blumea sp., Tridax procumbens*

Of these three categories. It is the crop plants which are mostly preferred by the bees of this tahsil. The crop plants *Lathyrus sativus* and *Cajanus cajan* and *Capsicum annuum* cultivated extensively during winter constitute the chief bee plants. Of this tehsil during winter seasons of the *Cajanus cajan*&*Lathyrussativus* represents most preferred nectar sources for the honeybees. Our observation indicate that *Lathyrus sativus* and *Cajanus cajan* represent abundant nectar and pollen sources to *Apis dorsata*.

The region selected for the present study has good potential for sustaining beekeeping ventures because of the diversity of nectar andpollen taxa. Since *Cajanus cajan, Lathyrus sativus* are major sources of forage for honey bees efforts should be made to increase. Their cultivation under social forestry like *Prosopis juliflora*. In the family like *Fabaceae , Asteraceace, Lamiaceace, Capparidaceace, Solanaceace* in these areas. To improve the beekeeping industry a proper understanding and mutualism between bees and available plant taxa in he region and in a particular season is necessary. The identified taxons were not only the economic crops but also play an important role in the development of beekeeping in these areas.

These data reflects the floral situation of the place were particular honey was produced and the identification of geographical origin based on the presence of a combination of pollen types of that particular area.

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