CODEN [USA]: IAJPBB ISSN: 2349-7750

INDO AMERICAN JOURNAL OF
PHARMACEUTICAL SCIENCES

http://doi.org/10.5281/zenodo.967448

Available online at: http://www.iajps.com Research Article

A MELITTOPALYNOLOGICAL INVESTIGATION OF WINTER HONEYS COLLECTED FROM *APIS DORSATA* HIVES OF SINDEWAHI TAHSIL OF CHANDRAPUR DISTRICT OF MAHARASHTRA STATE (INDIA)

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Abstract:

The paper incorporates a qualitative and quantitative study of pollen contents in 8 squeezed honey samples collected from forest area of Sindwahi tahsil of Chandrapur district. Cajanus cajan(52.12%) and Celosia argentea (45.5%) represents the predominant pollen type in 2 sample are designated as represents the predominant pollen type in 2 sample are designated as Cajanus honey and Celosia honey. The other significant pollen types recorded include Cajanus Cajan, Celosia argentea, Hyptis suavetens, Prosepis juliflora, Capparis grandis, Cloame gyanandra, Capsicum annuum. Dodonea viscora.

The pollen counts ranged from 6,000 to 935,000. 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

Keywords: *Pollen, Honey, Apis dorsata, Sindewahi tahsil.*

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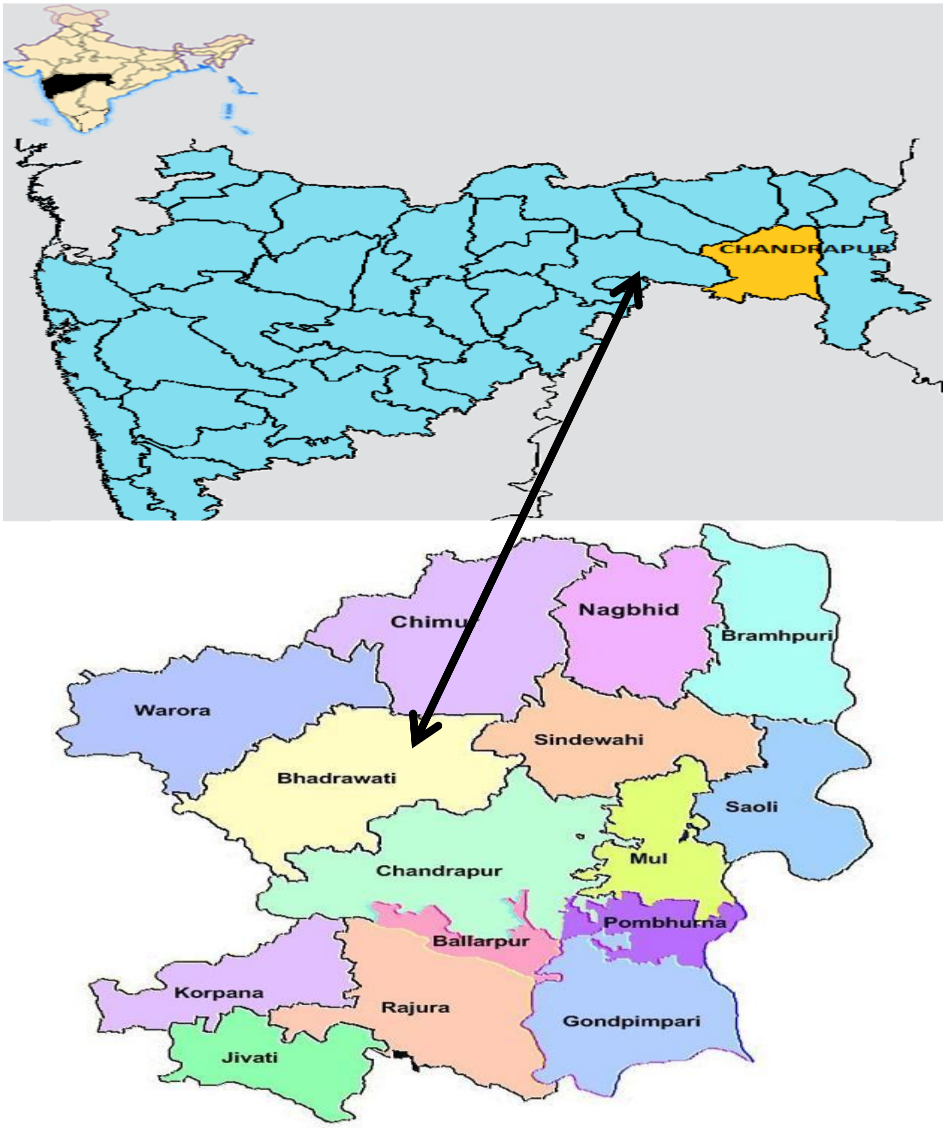
Please cite this article in press as Laxmikant N. Borkar and Devendra M. Mate, ***A Melittopalynological Investigation of Winter Honeys Collected from Apis Dorsata Hives of Sindewahi Tahsil of Chandrapur District of Maharashtra State (India),*** *Indo Am. J. P. Sci, 2017; 4(09).*

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 [1-5], Andra Pradesh [6-8], Karnataka [9-12], and Lucknow [13-16].

An investigation incorporates a quanlitative and quantitative pollen analysis of four honey sample from forest area of Sindewahi tahsil of Chandrapur district (Text fig. 1). 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:

Eight honey samples viz., CHN-SIN-Min, CHN-SIN-Rat, CHN-SIN-Naw, CHN-SIN-Del, CHN-SIN-Pur, CHN-SIN-Lon, CHN-SIN-Nac , CHN-SIN-Nan were collected during the period October 2011 to December 2012 from Minghari, Ratnapur, Nawargaon, Delanwadi, Purkepar, Lonwahi, Nanchanbhatti, Nandgaon. All the samples represent squeezed honey collected from the natural *Apis dorsata* hives.

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 determines the frequencies of melliferous pollen types (ICBB 1978). The absolute pollen counts of each sample were 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 8 honey sample collected from Sindewahi tehsil ***Cajanus cajan*** (52.12%) represented the predominant pollen type in one sample (CHN-SIN-Lon) and ***Celosia argentea***(45.5%) represented the predominant pollen type in second sample (CHN-SIN-Rat). While 6 are multifloral(CHN-SIN-Min),(CHN-SIN-Naw),(CHN-SIN-Del), (CHN-SIN-Nac),(CHN-SIN-Pur),(CHN-SIN-Nan) . The other significant pollen types recorded includes (secondary to minor pollen) Cajanus cajan, Capsicum annuum, Lathyrus sativus, Capparis grandis, Celosia argentea, Cloame gynandra, Hytis suaveolens, Blumea sp., Mimosa sp.

All together 29 pollen types (27 of melliferous and 2 of non-melliferous taxa) referable to 17families have been recorded from these samples (Photoplates). The sample Aawalgaon (CHN-SIN-Nach) shows Maximum number of pollen type each (15) and the sample (CHN-SIN-Lon) the minimum number (08) and had no minar pollen type in the sample. However the pollen of Sorghum vulgare was found to b good number (10.83%). The absolute pollen counts ranged from 6,000/g to 935,000/g and the HDE/P ratio ranged from 0.01 to 0.04 and represented by fungal spores(Table 1).

Table 1: Pollen frequency class and frequencies (%) in *Apis dorsata* honey.

Sample No.	Date of Collection	Type of Honey	Absolute pollen counts (APC) / g	HDE/P	Pollen Type
CHN-SIN-Nan	16-12-2011	Multiflora	454,000	0.01	P –**Nil** S - **Cajanus cajan(41.83)** **Capsicum annuum(37.08)** **I - Cloame gynandra(6)** **Capparis grandis(5.65)** **Celosia argentea(5)** M – Lat(1.5), Ci(1.16), Pa(0.83), He(0.33), All(0.16), NMP –**Nil**
CHN-SIN-Rat	27-10-2012	Unifloral	440,000	0.02	P – **Celosia argentea(45.5)** S - **Cajanus cajan(20.33)** I - **Lathyrus sativus(9.16)** **Blumea sp.(6.6)** **Capsicum annuum(5.16)** **Capparis grandis(3.66)** **Lagascea mollis(3)** M – Mi(2.16), Pr, Tri(each 1.83), Cor(0.60), Mo(0.6) NMP –**Nil**

CHN-SIN-Pur	28-11-2012	Multifloral	96,000	0.01	P –**Nil** S - **Capsicum annuum(31.66)** **Cajanus cajan(21.83)** **Capparis grandis(16.33)** I – **Lathyrus sativus(10.16)** **Blumea sp.(5.33)** **Mimosa sp.(3)** M – Cel(2.66), Hy(2.33), Pr(1.83), Ps(1.16), Cas, Ci(each 0.83), Cor(0.5) NMP –**Sorghum Vulgare(10.83**)
CHN-SIN-Lon	30-11-2012	Unifloral	120,000	0.01	P –Nil S - Cajanus cajan(31.33) Capsicum annuum(16.83) Capparis grandis(16.16) I - Citrus sp.(7.66) Pisidium guajava(3.33) Leucaena leucocephala(4) Blumea sp.(3.16) Coriandrum sativum(8.66) M –Cl(1.83), Pr(2.66), Hy(0.5), Ju(1.33)Bou(1.16) NMP – Holopteled integrifoloa(0.25)
CHN-SIN-Nach	09-12-2012	Multifloral	454,000	0.01	P –**Nil** S - **Cajanus cajan(30.5)** **Celosia argentea(20.66)** I - **Capsicum annuum(12.5)** **Hyptis suaveolens(12.33)** **Lathyrus sativus(9.5)** **Cloame gynandra(6.5)** **Sonchus oleraceus(3.33)** M – Br(1.5), Mi(1.33), Bl(1.16), He(0.66), Mo, May(each 0.5), Ps(0.33), NMP – **Sorghum Vulgare(0.58)**
CHN-SIN-Naw	30-10-2011	Multifloral	12,000	0.02	P –**Nil** S – **Cajanus cajan(35.05)** **Capsicum annuum(24.83)** **Lathyrus sativus(17.83)** I –**Capparis grandis(7.16)** **Sphaeranthus indicus(4.20**) **Hyptis suaveolens(3.30)** **Celosia argentea(3)** M – Car(1.80), Ci,Ps(each 1), Par(0.83), NMP – **Nil**
CHN-SIN-Del	2-11-11	Multifloral	935,00	0.01	P –**Nil** S - **Cajanus cajan(14.25)** **Capsicum annuum(3.75)** I – **Capparis grandis(9)** **Cloame gynandra(4)** **Hyptis suaveolens(3.83)** **Blumea sp.(3.5)** **Maytenus emarginatus(3.16)** **Sonchus oleraceus(3)** M –Tri(1), Bi(0.66), Mi(0.5) NMP –**Nil**
CHN-SIN-Min	25-10-11	Multifloral	195,000	0.03	P –**Nil** S - **Cajanus cajan(27.5)** I - **Celosia argentea(14.83)** **Lathyrus sativus(14.5)** **Capparis grandis(13)** **Capsicum annuum(11.02)** **Hyptis suaveolens(7.5)** **Cleome gyndra(7.16**) M –Tri(1.83), La(1), Ci, Bl(0.83) NMP – **Amaranthus/** **Achyranthus(0.66)**

The details of the pollen analysis of the 8 honey sample (melliferous / non-melliferous) are represented in table 2. Similarly individual palynograph (pollen spetra) of each honey sample and composite palynograph was also given to show the pollen contents of the same of Sindewahi tehsil.

The distinguishing morphological features of the pollen types encountered in the present study are given below.

Table 2: Showing pollen morphology of Melliferous/Non- Melliferous taxa

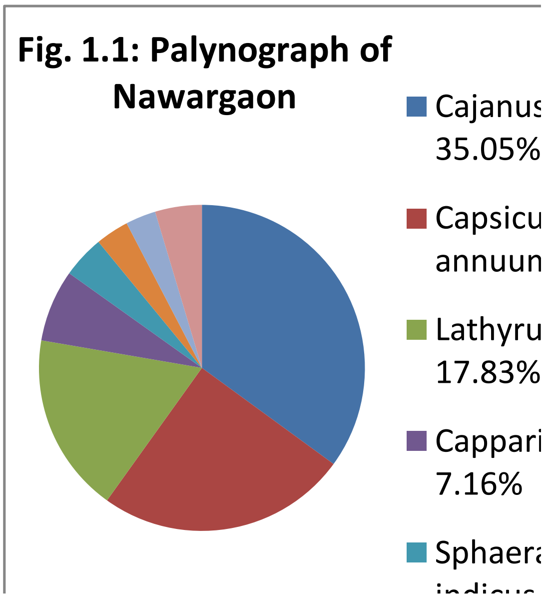
Sr. No.	Pollen Type	Size, Shape & Symmetry	Aperture Pattern	Pollen Wall (sporoderm) structure & sculpture
01	***Allium cepa*** Linn.	14-28× 32-48µm, ellipsoidal, Bilaterally symmetrical	Monosulcate, sulcus tenuimarginate	Exine 1.5 µm thick, subtectate, surface faintly reticulate
02	***Brassica*** sp.(Linn) Koch	30-33 µm , Amb rounded triangular to almost spheroidal; 27-31× 24-27 µm, prolate spheroidal; radially symmetrical	Tricolplate , colpal ends tapering, tips acute	Exine 2.5 µm thick, sub tectate, surface reticulate, heterobrochate, meshes narrow at mesocolpial regions giving a striate look , lumina polygonal.
03	**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
04	**Bidena pilosa** Linn.	25-29 µm Amb spheroidal; 23-25× 27-30 µm, sub-oblate; Radially symmetrical	Tricolprate, colpi long, ends tapering, tips acute, ora lalongate	Exine 1.5 µm thick,tectate, surface echinate, spines 6.8 µm long, base 2µm broad
05	**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
06	**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
07	**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
08	**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
09	***Careya arborea*** Roxb.	52.1× 40.1 µm (48-54× 37.5 -43.5) µm, subprolate, isopolar, radially symmetrical	Hexacolpate, syncolpate with crassimarginate colpi, col. Length 43.5 (42-46.5) µm	Exine thick , 3 µm, undulating, considerable thick at the poles sexine-nexine not differentiated medium reticulate, more coarse at the poles. Mesh 1.5-3 µm, clear LO pattern
10	**Cloame 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
11	**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
12	**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
13	***Casearia elliptica*** Willd	29-37µm, Amb spheroidal ; 28-36 ×27-33 µm subprolate radially symmetrical	Tricolporate , colpi with tapering ends, ora lalongate	Exine 1.5 µm thick, tectate, surface psilate
14	***Helianthus annuus***	40-44 µm, Amb spheroidal, 37-39×	Tricolporate , colpal	Exine 3 µm thick (without spines), tectate,

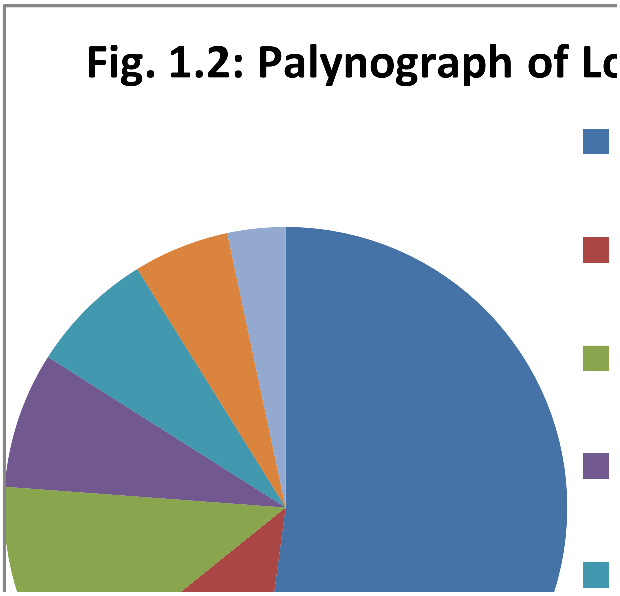
	Linn.	40-42 µm, oblate spheroidal; Radially symmetrical	ends tapering, ora lalongate	surface densely echinate, spines 7-8 µm long, base 2.4 µm wide, tip pointed.
15	**Hyptis suaveolens** (Linn.) Poit.	35-39 µm, Amb spheroidal; 32-35× 36-39 µm, oblate spheroidal ; Radially symmetrical	Hexacolpate, colpi 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.
16	***Lagascea mollis*** Cav.	38-42 µm, Amb spheroidal to rounded triangular; 33-35 × 39-43 µm, oblate spheroidal ; Radially symmetrical	Tricolporate, colpi linear, tips acute, ora lalongate	Exine 5 µm thick tectate, surface echinate, spines 6.5 µm long, base 2.3 µm broad
17	**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.
18	***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
19	***Momordica charantia*** Linn.	68-76 µm, Amb spheroidal; 67-72× 64 -65 µm, prolate spheroidal; radiallysymmetrical	Tricolporate , colpi narrow with tapering ends, ora faint , lalongate	Exine 4 µm thick, subtectate, surface reticulate, lumina irregularly polygonal psilate
20	***Maytenus emarginata*** Wild.	Oblate, 45-49 µm, Amb, rounded triangular to almost spheroidal , isopalar, Radially symmetrical	Tricoloporate, colpi length 9.4 µm, (9-10.5) µm, ora lalongate	Exine thick 3 µm, sexine thicker than nexine, reticulate size of mesh 2.4 (1.5-3) µm, distinct LO pattern.
21	**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
22	**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
23	**Parthenium hysterophorus** Linn.	16.6 to 19.8 µm, Amb spheroidal , oblate spheroidal, radially symmetrical	Tricolporate colpi long, ends tapering, tips acute, ora lalongate	Exine 3 µm thick, tectate, surface echinate, spines short 2 µm, to 3 µm, , long 2 µm, in diam at base.
24	***Sonchus oleraceus*** Linn.	39-44 µm, Amb more or less hexagonal with rounded corners, sides straight to slightly convex; 37-47x 40-45 µm oblate spheroidal , Radially symmetrical	Tricolporate, colpi faint due to heavy sculpture, ora lalongate	Exine upto 12 µm thick, tectate, sexine much thicker than nexine at ridges, surface echinolophate echinofene strate), spines of different sizes, upto 3 µm long, fenestral lumina upto 21, polygonal to irregular, psilate, 6-8 prominent ridges are soon along the equator which join the equatorial lacuna of both the hemispherrrrres
25	***Sphaeranthus indicus*** Linn.	28-33 µm, Amb spheroidal; 26-29x 30-34 µm, suboblate; Radially symmetrical	Tricolporate, colpilinear, tips acute ora lalongate	Exine (without spines) 3 µm thick, tectate, surface echinate, spines 4-5 µm long , 3 µm broad at the base
26	**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

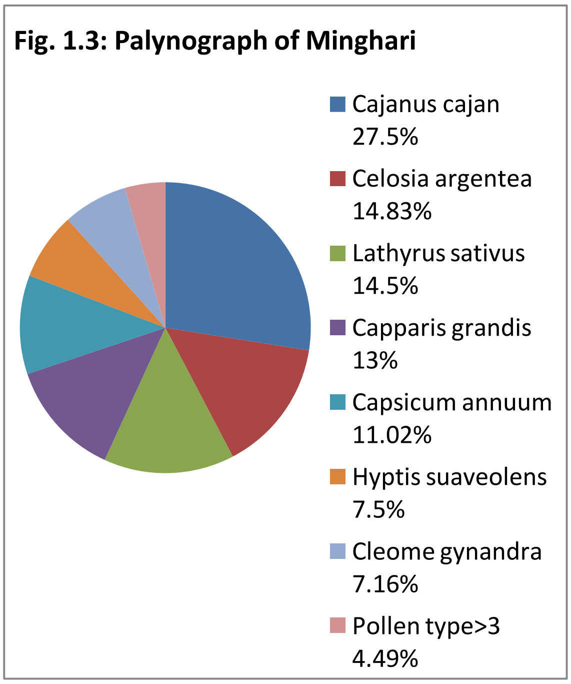
Non- melliferous taxa

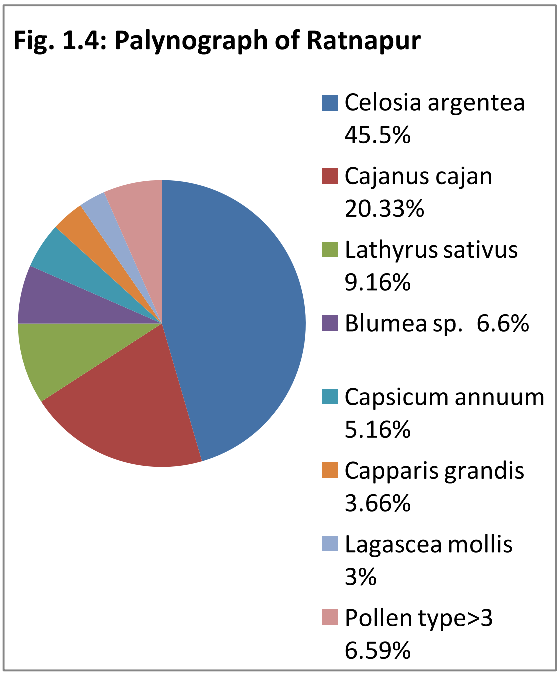
1	***Amaranthus/Achyranthus*** sp.	19-36 µm, spheroidal; Radially symmetrical	Pantoporate, pores, 25-35 in number, circular, 2-3 in diam, interporal distance 3-5 µm	Exine 1.5 µm thick, tectate, interporal space finely granular
2	**Sorghum vulagare** Pers.	51-55 µm, spheroidal; Radially symmetrical	Monoporate, 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









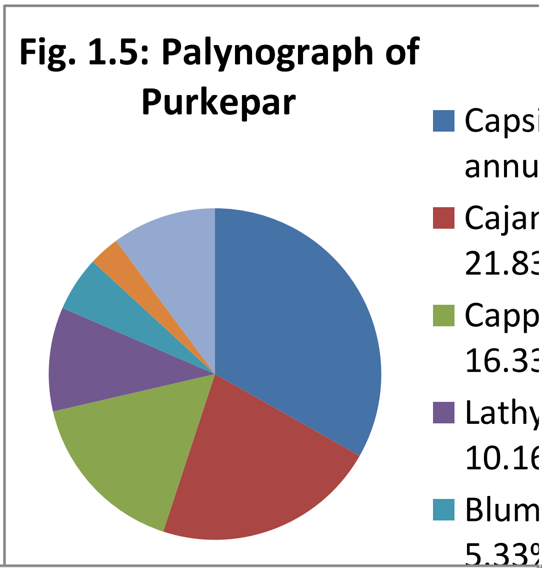


Fig. 1.5: Palynograph of Purkepar

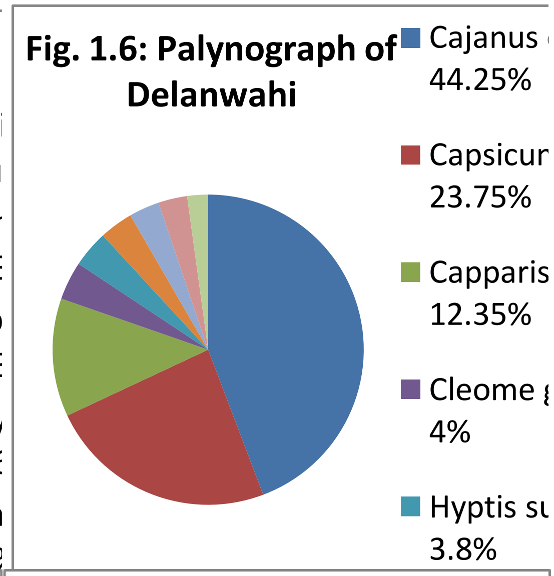


Fig. 1.6: Palynograph of Delanwahi

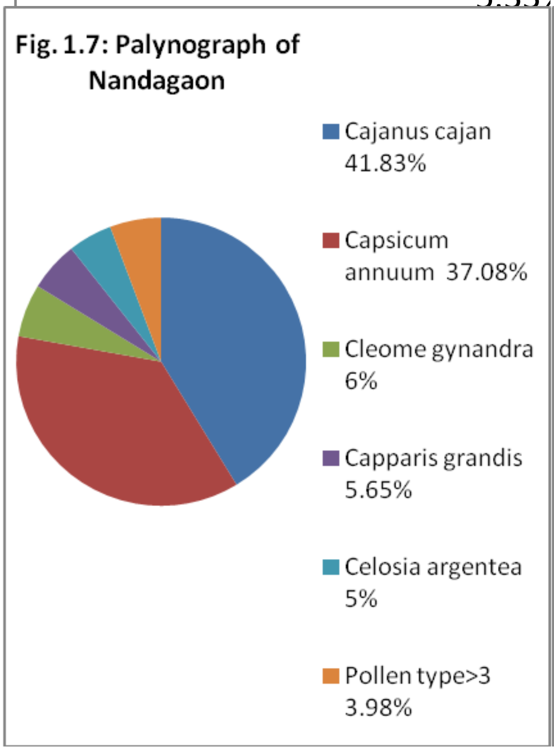


Fig. 1.7: Palynograph of Nandagaon

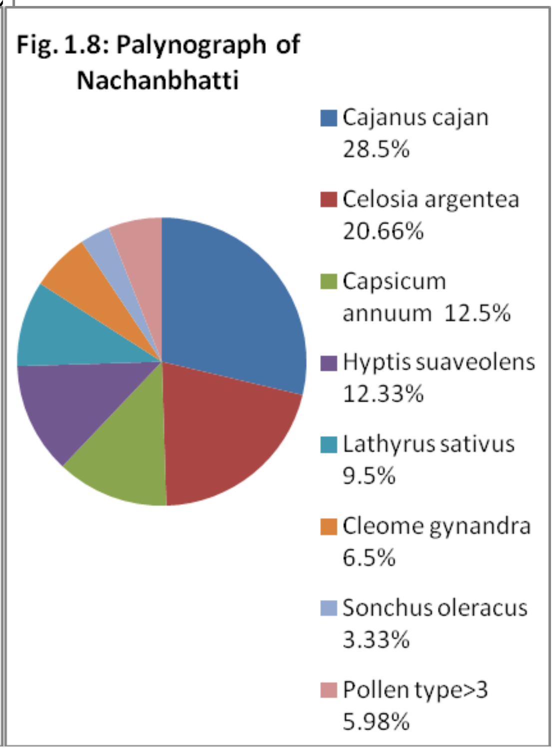
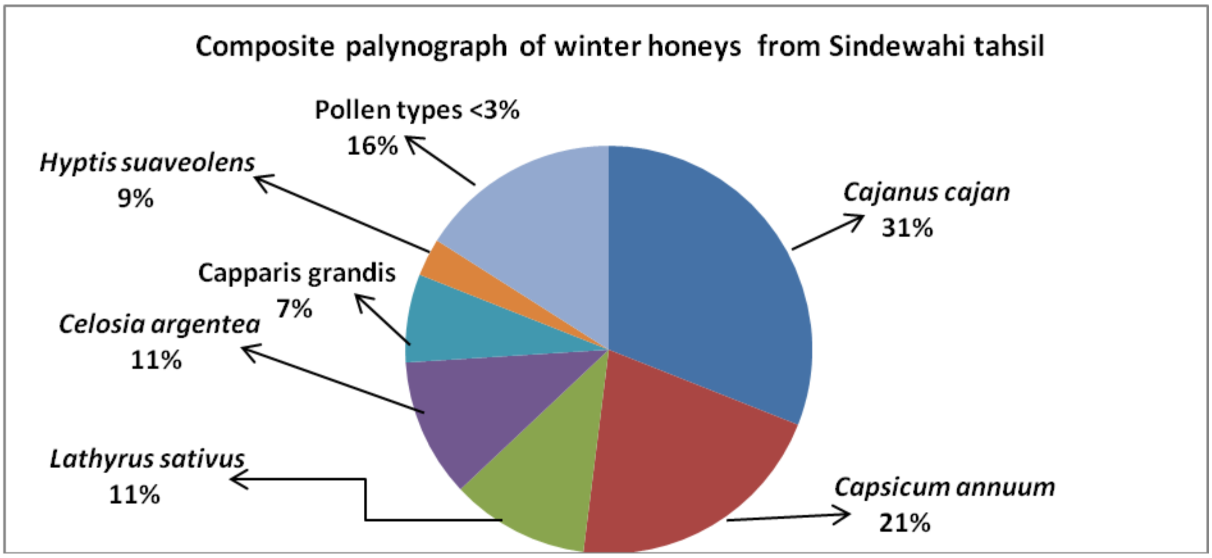
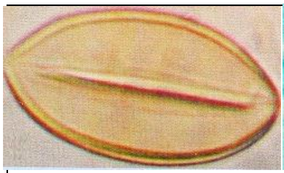
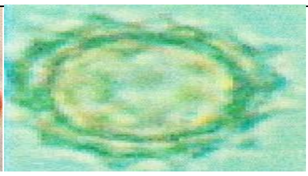
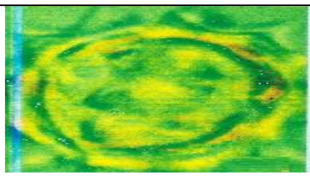
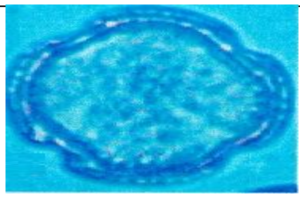


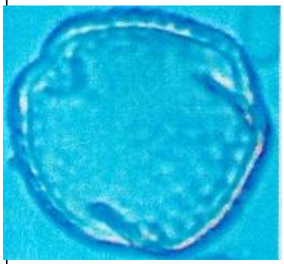
Fig. 1.8: Palynograph of Nachanbhatti

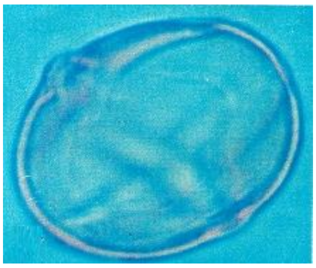


PhotoPlate: Microscopic photograph of pollen grains found in honey sample

Allium cepa Blumea sp. Bidena pilosa Citrus sp.

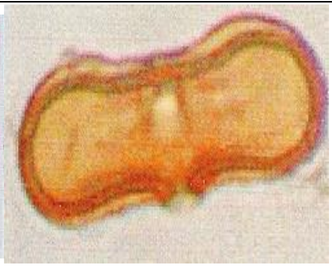




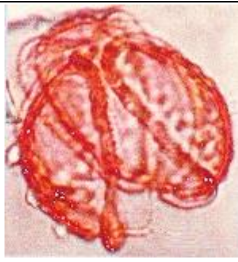

Cajanus cajan Capparis grandis Capsicum annuum Brassica sp.

Cloame gynadra

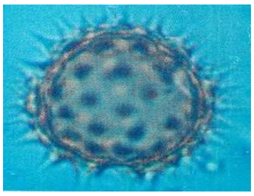
Celosia argentea



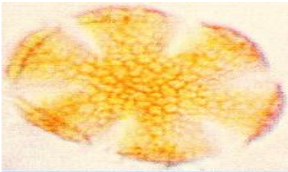
Coriandrum sativum



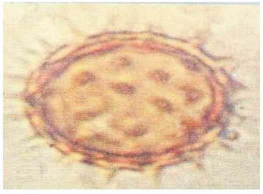
Careya arborea



Helianthus annuus

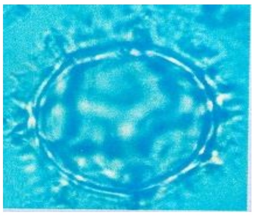


Hyptis suaveolens

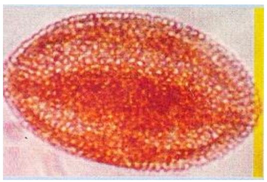


Lagascea mollis

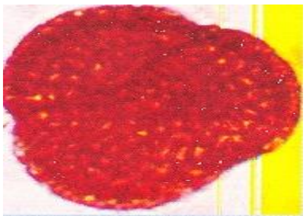
Lathyrus sativus



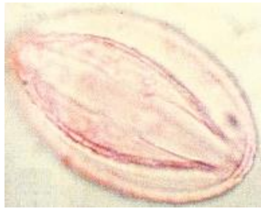
Sochaus oleraceus



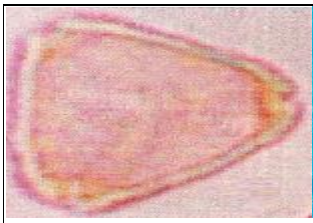
Momordica charantia



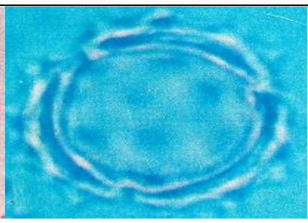
*May*tenus emarginata



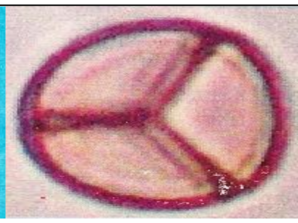
Prosopis juliflora



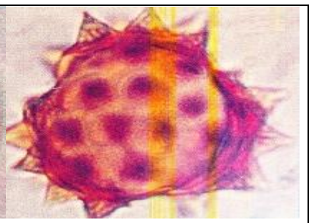
Psidium guajava



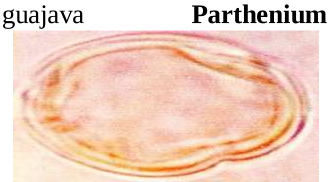
Parthenium hysterophorus



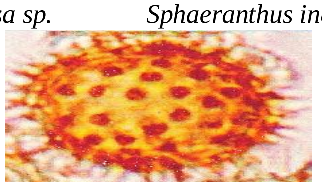
Mimosa sp.



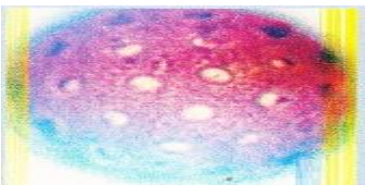
Sphaeranthus indicus



***3Cas*earia elliptica**



Tridax procumbens



Amaranthus / Achyranthus sp.

Sorghum vulagare

The bee plants of Sindewahi tahsil are referable to 3 categories:

1) Crop plants: *Cajanus cajan, Lathyrus sativus,Cariandrum sativus, Capsicum annuum* and *Momordica charantia* **,** Brassica sp., *Sorghum vulgare***.**

2) Arborescent taxa/shrub: *Pisidium guajava, Capparis grandis, Prosopis juliflora, Mimosa sp...*

3) Herbaceous weeds: *Celosia argentea, Hyptis suaveolens, Blumea sp., Tridax procumbens, Helianthus annus, Bidens pilosa, Sphaeranthus indicus, Parthenium hysterephorus, Sonchus oleraceaus, Allius cepa, Cleome gyandra, Lagascea mollis.*

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