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Melittopalynological Investigation of Winter Honeys Collected From Apisdorsata Hives of Nagbhidtahsil of Chandrapur District of Maharashtra State (India)

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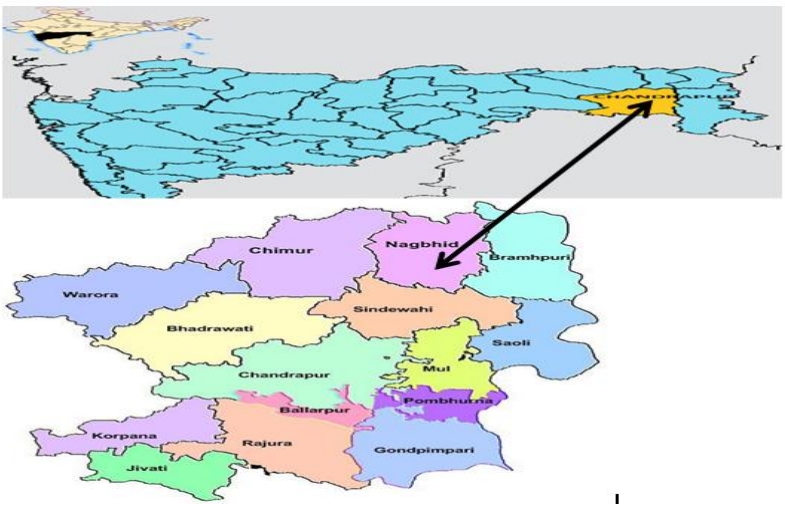
ABSTRACT: The paper incorporates a qualitative and quantitative study of pollen contents in four squeezed honey samples collected from forest area of Nagbhidtahsil of Chandrapur district.Cajanuscajan(50.91% and Capparisgrandis (45.50%) represents the predominant pollen type in 2 sample are designated as Cajanus honey and Capparishoney. The other significant pollen types recorded include Cajanuscajan, Tridaxprocumbens, Capparisgrandis, Celosia argentea, , Cloamegyanandra, Capsicum annuum.Blume a sp..
The pollen counts ranged from 5,000 to 460,000. 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, Apisdorsata, Nagbhidtahsil.

I. 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(BorkarLamikant& MateDevendra 2014;2016,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; Bhargavaet al., 2009), Lucknow (Suryanarayana, 1976) and Indian honeys (Sen and Banarjee, 1956; Nair, 1964; Seethalakshmi, 1993). Investigations incorporates a quanlitative and quantitative pollen analysis of four honey sample from forest area of Nagbhidtahsil 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.



II. MATERIALS AND METHODS

Four honey samples viz., CHN-NAG-Saw, CHN-NAG-Aaw, CHN-NAG-Gir, CHN-NAG-Yen were collected during the period Nov 2011 to Dec 2012 from Sawargaon, Aawalgaon, Girgaon, Yenoli. all the samples represent squeezed honey collected from the natural Apisdorsata 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 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, hyphalshreads and algal filaments).

III. RESULTS AND DISCUSSION

Of the 4 honey sample collected from Nagbhidtahsil (CHN-NAG-Raj) **Capparisgrandis**(45.50%) represented the predominant pollen type in one sample (CHN-NAG-Saw),**Cajanuscajan** (50.15%) represented the predominant pollen type in second sample (CHN-NAG-Aaw), while 2 are multifloral(CHN-NAG-Gir), (CHN-NAG-Yen). The other significant pollen typesrecorded includes (secondary to minor pollen) Cajanuscajan,Tridaxprocumbens,Capparisgrandis,Cloamegynandra, Celosia argentea, Capsicum annuum, Blumea sp..

All together 30pollen types (27 of melliferous and 3 of non-melliferous taxa) referable to 21families have been recorded from these samples (Photoplates).The sample Aawalgaon(CHN-NAG-Aaw) and Girgaon(CHN-NAG-Gir) shows Maximum number of pollen type each (17) and the sample(CHN-NAG-Saw) the minimum number (12) .The absolute pollen counts ranged from 5,000/g to 460,000/g and the HDE/P ratio ranged from 0.01 to 0.04(Table 1).

Table1:Pollen frequency class and frequencies(%) in Apisdorsata honey.

Sample No.	Date of Collection	Type of Honey	Absolute pollen counts (APC) / g	HDE/P	Pollen Type
CHN-NAG-Saw	15-11-2011	Unifloral	445,000	0.01	P –Capparisgrandis(45.5) S - Nil I - Cloamegunandra(10.33) Blumea sp.(10.33) Capsicum annuum(10) Lathtrussativus(4.23) Cajanuscajan(5.83) Celosia argentea(6.16) Citrus sp.(4.83) M –Si(2.33), Bau(2.5), Par(1.5) NMP – Holopteledintegrifoloa(0.75)
CHN-NAG-Aaw	11-11-2012	Unifloral	460,000	0.02	P – Cajanuscajan(50.91) S - Nil I - Capparisgrandis(12.33) Celosia argentea(8.16) Cloamegunandra(3.5) Hyptissuavedens(4.16) Lathtrussativus(4.5) Blumea sp.(7.5) Dodoniaviscisa(3) M –Tri(1.83), Ps(0.33), Ve(0.16), Ti(2.16), Par(0.5)Cart(2.66) NMP – Sorghum Vulgare(0.18) Typhaangustata(0.14) Holopteledintegrifoloa(0.20)

CHN-NAG-Gir	13-12-2012	Multifloral	78,000	0.02	P –Nil S - Cajanuscajan(20.16) I – Tridaxprecumbens(12.33) Bidenspilosa(3.66) Hyptissuaveolens(7.83) Celosia argentea(8.5) Ocimumbasilicum(35) Vernomiacineria(3.16) Blumea sp.(6.16) Cloamegunandra(8.5) Capparisgrandis(4.5) Capsicum annuum(7.16) M –He(1.5), Sp(1.6), Cart(2.16), Mo(2.66), Ps(1.33) NMP – Sorghum Vulgare(0.75)
CHN-NAG-Yen	23-12-2012	Mutlifloral	5,000	0.04	P –Nil S - Cajanuscajan(31.33) Capsicum annuum(16.83) Capparisgrandis(16.16) I - Citrus sp.(7.66) Pisidiumguajava(3.33) Leucaenaleucocephala(4) Blumea sp.(3.16) Coriandrumsativum(8.66) M –Cl(1.83), Pr(2.66), Hy(0.5), Ju(1.33)Bou(1.16) NMP – Holopteledintegrifoloa(0.25)

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.

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	**Bauhinia variegata**L.	36.63- 46.62 µm spheroidal-prolate spheroidal radially symmetrical	Triangular equatorial outline elliptic, Tricolporpoidatecolpi 36.39 × 46 µm colpi long narrow toward the ends	Exine thick 3.33- 4.99 µm sculpturing striate
02	**Blumea** sp.	21-24 µm, Amb spheroidal, isopolar, Radially symmetrical	Tricolprate, colpilong	Exine 3 µm thick, surface echinate, spines 5-6 µm long, 4 spines in the inter apertural region interspinal area psilate
03	**Bidenapilosa**Linn.	25-29 µm Amb spheroidal; 23-25× 27-30 µm, sub-oblate; Radially symmetrical	Tricolprate, colpi long, ends tapering, tips acute, oralalongate	Exine 1.5 µm thick,tectate, surface echinate, spines 6.8 µm long, base 2µm broad
04	**Citrus** sp.	27-29 µm, Ambsquarish, 26-30 ×25-27 µm, prolate spheroidal radially symmetrical	Tetracolporate, colpi linear, tips acute, oralalongate	Exine 2 µm thick subtectate, surface Reticulate. Heterobrochate, meshes smaller near the apertural regions and larger elsewhere, luminahexa to pentagonal or irregular, psilate, murisimpli to locally duplibaculate
05	**Cajanuscajan** (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, luminahexa to pentagonal, psilate, murisimplibaculate
06	**Capparisgrandis** Linn.	10-12 µm , Amb spheroidal;	Tricolporate, colpi linear	Exine 1 µm thick, tectate,

		14-16 ×9-12 µm prolate to subprolate; Radially symmetrical	to narrowly elliptic, ends tapering, tips acute, ora faint lalongate	surface faintly granular to almost psilate
07	**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
08	**Carthamustinctorius**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
09	**Cloamegynadra** Linn	19-21 µm, Amb spheroidal, 18-22 ×14-16 µm, prolatespheroidal; radially symmetrical	Tricolporate, colpi with tapering ends, ora faint, lalongate	Exine 1 µm thick, sub-tectate, surface finely reticulate, homobrochate, lumina polygonal, smooth, murisimplibaculate
10	**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
11	**Coriandrumsativum** Linn.	23-28 µm, Ambseenonly occasionally , rounded triangular; 35-28× 15-16 µm perprolateconstricated of the equator, Radially symmetrical	Tricolporate, colpi long, narrow, oralalongate to circular	Exine 1.5-2 µm thick at poles and 2.5 – 3.5 µm thick at equator, subtectate, surface finely reticulate
12	**Dodonaeaviscosa**(Linn). Jacq.	29-32 µm, Ambsubtriangular 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, oralalongate with Plate Fig.heavyendexinous thickening on the polar sides.	Exine 2.5 µm thick, subtectate, surface faintly microreticulate
13	**Helianthus annuus** Linn.	40-44 µm, Amb spheroidal, 37-39× 40-42 µm, oblate spheroidal; Radially symmetrical	Tricolporate , colpal ends tapering, oralalongate	Exine 3 µm thick (without spines), tectate, surface densely echinate, spines 7-8 µm long, base 2.4 µm wide, tip pointed.
14	**Hyptissuaveolens** (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, murisimplibaculate.
15	**Justiciaprocumbens** Linn.	24-28× 16-18 µm, oblong; Bilaterally symmetrical	Dicolporate, colpi faint, narrow, streak like, oralalongate	Exine 1 µm thick at poles, 2.5 µm thick at equator, tectum undulating, circular to irregular areoies (2-4 µm) aligned linearly are seen on either side of the colpi, rest of the wall finely reticulate
16	**Lathyrussativus** Linn.	42 × 31.5 µm, prolate to perprolate , Radially symmetrical	Tricolporate, colpilong, ends tapering, ora circular to slightly lalongate	Exine 1.5 µm thick, subtectate, surface reticulate.
17	**Leucaenaleucocephala** (Lam.) de Wit	52-59 µm, Amb spheroidal : 47-49×51-58 µm, sub oblate: Radially symmetical	Tricolporatecolpilong, tips acute, oralalongate	Exine 4 µm thick, subtectate surface microreticulate, homobrochate
18	**Momordicacharantia** 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
19	**Ocimumbasilicum**Linn.	41-45 µm, Amb spheroidal; 41-46× 36-39 µm subprolate; Radially symmetrical	Hexacolpate, colpi broad with somewhat blunt ends, colpal membrane densely granular	Exine 4 µm thick, subtectate, surface prominently reticulate, homobrochate, lumina polygonal, beset with many free piloid elements, murisimplibaculate
20	**Prosopisjuliflora**(Sw.)	36-39 µm, Amb rounded	Tricolllporate,	Exine 3.2 µm thick, tectate

	DC	triangular; 38-42× 30-35 µm, prolate to subprolate; Radially symmetrical	occasionally syncolpate, colpi tapering towards poles, tips acute, oralalongate	surface faintly reticulate
21	**Psidiumguajava**Linn.	24-25 µm, Ambsubtriangular; 13-16× 26-28 µm, oblate; Radially symmetrical	Tricolporate, syncolpate, parasyncolpate, oralalongate	Exine 1.5 µm thick , tectate surface granular to pailate
22	**Partheniumhysterophorus**Linn.	16.6 to 19.8 µm, Amb spheroidal , oblate spheroidal, radially symmetrical	Tricolporatecolpi long, ends tapering, tips acute, oralalongate	Exine 3µm thick, tectate , surface echinate, spines short 2 µm, to 3 µm, , long 2 µm, in diam at base.
23	**Sidaglutinosa**cav	Large size 70.5 µm × 71.2 µm spheroidal radially symmetrical	Isopolarpentaporate pore 4.5 µm, interpolar distance 15-7 µm	Exine thick 4.5 µm, Sexine-nexine not clear, echinate, basal cushions well defined, spine height 4.5 µm cushion 3 µm thick, interspinal area to oveolatecolunellar fused in the basal cushion, clear LO pattern
24	**Sphaeranthusindicus** Linn.	28-33 µm, Amb spheroidal; 26-29x 30-34 µm, suboblate; Radially symmetrical	Tricolporate, colpilinear, tips acute oralalongate	Exine (without spines) 3 µm thick, tectate, surface echinate, spines 4-5 µm long , 3 µm broad at the base
25	**Tinosporacordifolia** (Wild) Miers ex hk. f. &Thoms.	16-18 µm, Amb rounded triangular; 15-19 ×12-17 µm, sub-prolate; Radially symmetrical	Tricolporate, colpi linear long, often meeting at poles without forming syncolpia, operculate, operculum as long as colpus, ora not distinct	Exine 1.5 µm thick, subtectae, surface finely reticulate, lumina variously polygonal
26	**Tridaxprocumbens** 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
27	**Vernoniacinerea** (Linn.) cess	35-38 µm, Amb spheroidal; 34-37 x 31-35 µm, prolate spheroidal; Radially symmetrical	Tricolporate, colpi fine and inconspicuous due to heavy sculpturing, ora more or less circular	Exine 6 µm thick, tectae , surface echinolophate (echinofenestrate), spines of different sizes, upto 3 µm long, fenestrallumina prominent, hexa to pentagonal sometimes irregular, 5-12 µm in dial psilate.

Non- melliferous taxa

1	**Holopteleaintegrifolia** (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
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
3	**Typhaangustata**Bory. et Chaub	28-35 µm, ellipsoidal, triangular or spheroidal; Radially symmetrical	Monoporate pore more or less circular 4-5 µm in diam, margin wavy, pore membrane densely granular	Exine 2.5 µm thick, subtectate, surface reticulate in places retipilate, reticulum homobrochate, lumina polygonal to circular, psilate, murisimplibaculate

Pie charts showing pollen spectra of Apisdorsata honeys samples

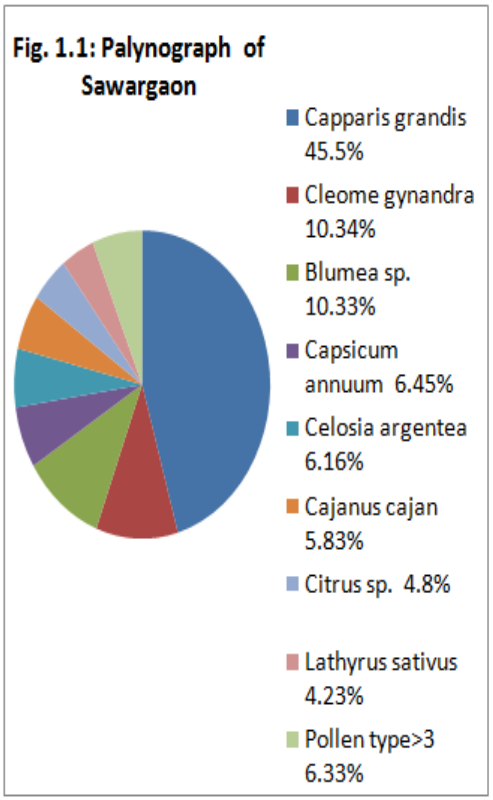


Fig. 1.1: Palynograph of Sawargaon
Capparis grandis 45.5%
Cleome gynandra 10.34%
Blumea sp. 10.33%
Capsicum annuum 6.45%
Celosia argentea 6.16%
Cajanus cajan 5.83%
Citrus sp. 4.8%
Lathyrus sativus 4.23%
Pollen type>3 6.33%

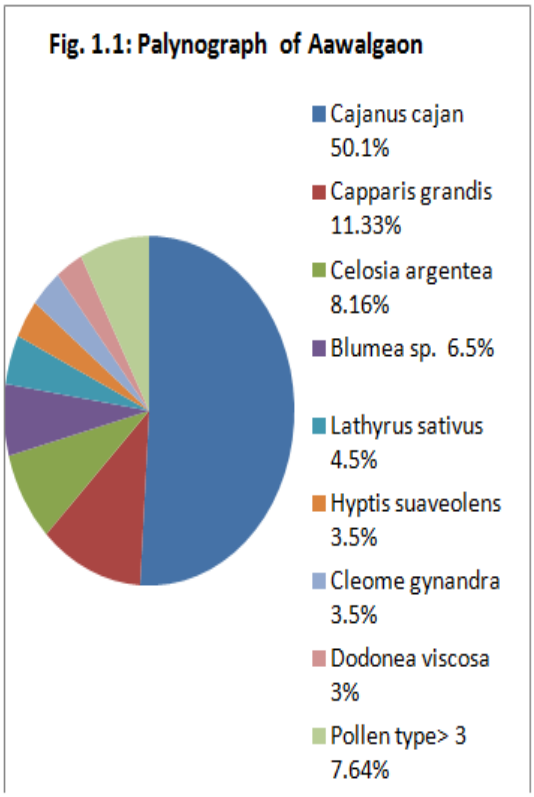


Fig. 1.1: Palynograph of Aawalgaon
Cajanus cajan 50.1%
Capparis grandis 11.33%
Celosia argentea 8.16%
Blumea sp. 6.5%
Lathyrus sativus 4.5%
Hyptis suaveolens 3.5%
Cleome gynandra 3.5%
Dodonea viscosa 3%
Pollen type> 3 7.64%

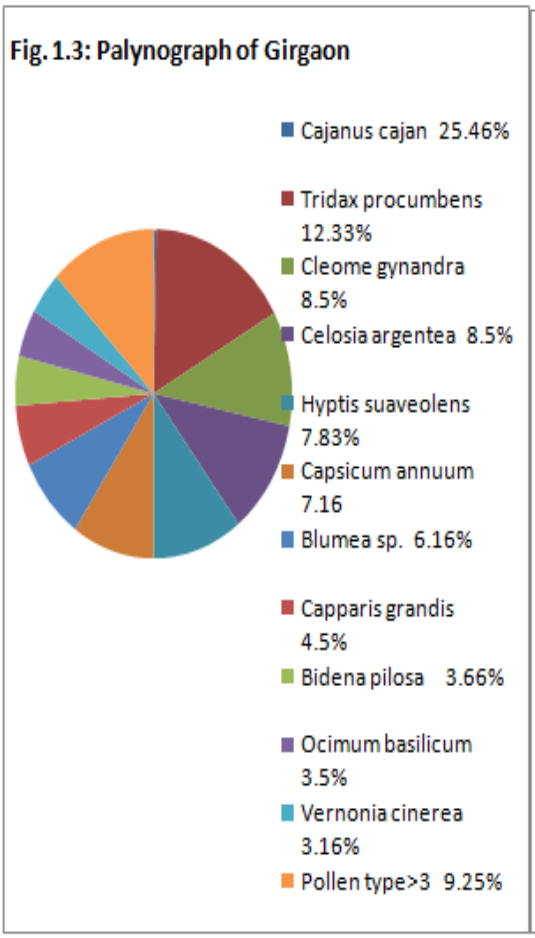


Fig. 1.3: Palynograph of Girgaon
Cajanus cajan 25.46%
Tridax procumbens 12.33%
Cleome gynandra 8.5%
Celosia argentea 8.5%
Hyptis suaveolens 7.83%
Capsicum annuum 7.16
Blumea sp. 6.16%
Capparis grandis 4.5%
Bidena pilosa 3.66%
Ocimum basilicum 3.5%
Vernonia cinerea 3.16%
Pollen type>3 9.25%

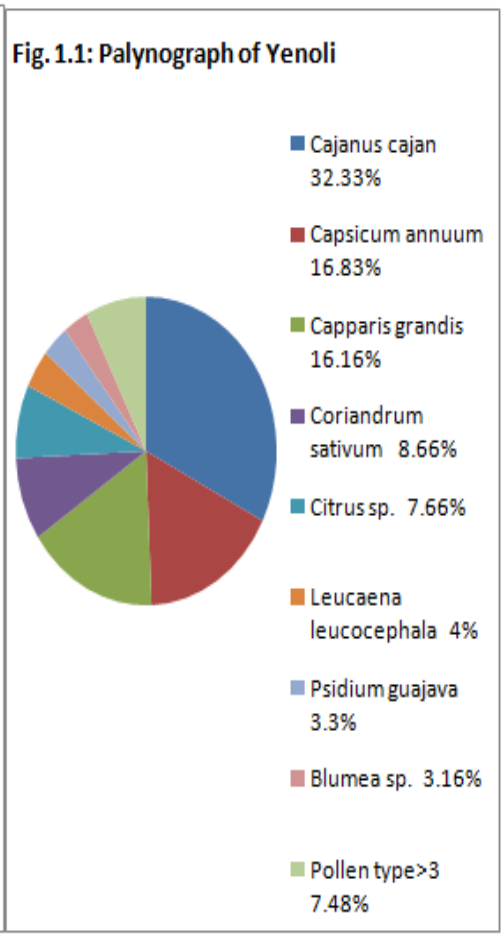


Fig. 1.1: Palynograph of Yenoli
Cajanus cajan 32.33%
Capsicum annuum 16.83%
Capparis grandis 16.16%
Coriandrum sativum 8.66%
Citrus sp. 7.66%
Leucaena leucocephala 4%
Psidium guajava 3.3%
Blumea sp. 3.16%
Pollen type>3 7.48%

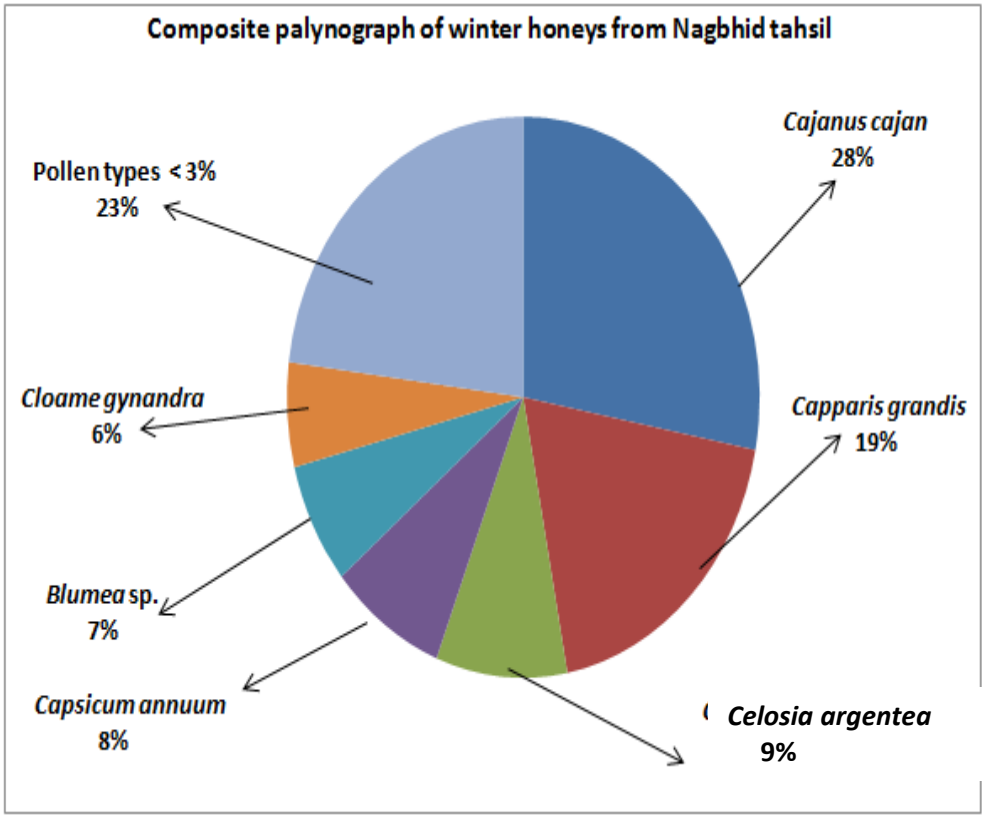
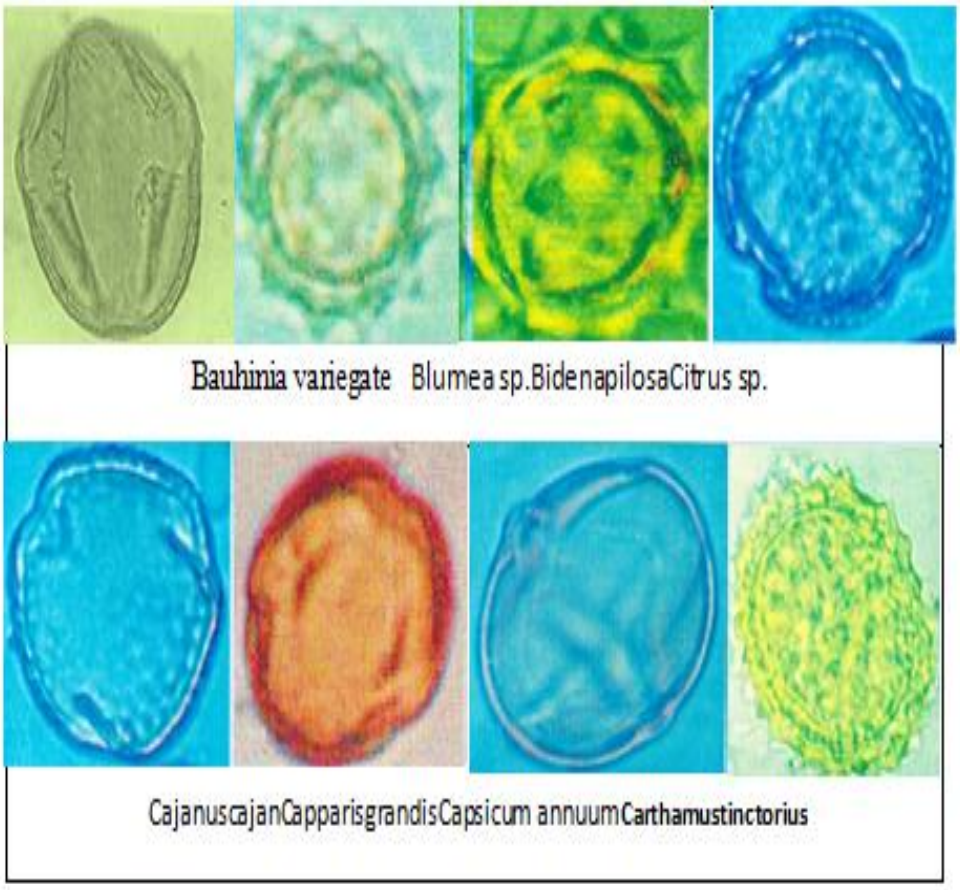
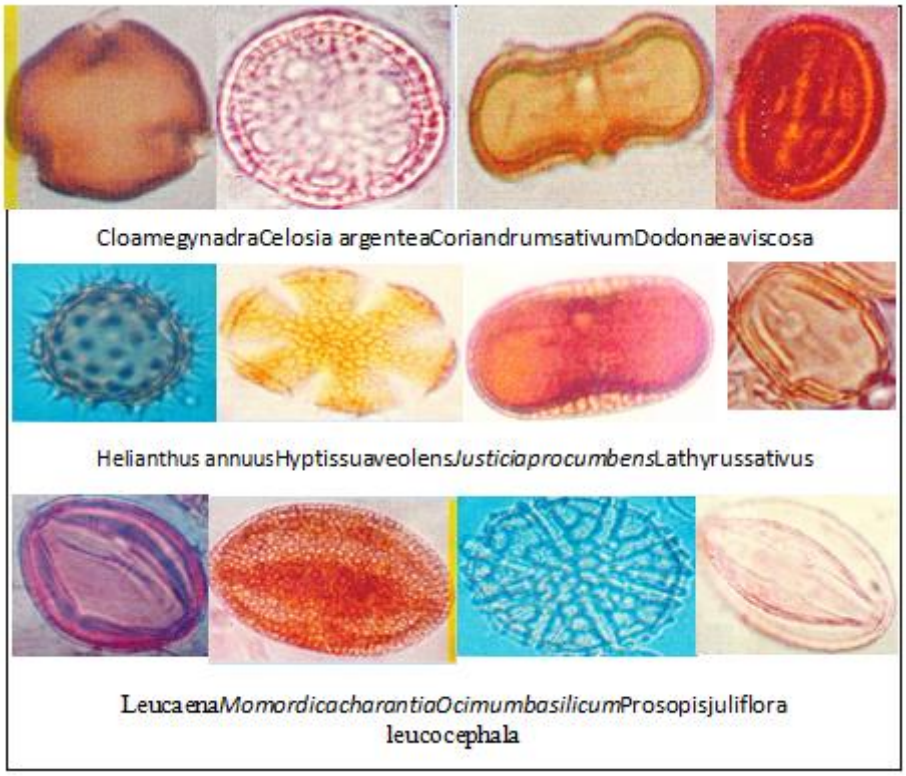


Photo Plate: Microscopic photograph of pollen grains found in honey sample





The bee plants of Nagbhidtahsil are referable to 3 categories:

1) **Crop plants**: Cajanuscajan, Lathyrussativus,Cariandrumsativus, Capsicum annuumand Sorghum vulgare**.**
2) **Arborescent taxa/shrub:**Pisidiumguajava, Dodoneaviscosa, Capparisgrandis, Prosopisjuliflora.
3) **Herbaceous weeds:**Celosia argentea, Hyptissuaveolens, Carthamoustincterius, Blumea sp., Tridaxprocumbens Of these three categories. It is the crop plants .which are mostly preferred by the bees of this tahsil. The crop plants Lathyrussativus and Cajanuscajan,Cariandrumsativusand Capsicum annuum cultivated extensively during winter constitute the chief bee plants. Of this tehsil during winter seasons of the Cajanuscajan&Lathyrussativus represents most preferred nectar sources for the honeybees. Our observation indicate that Lathyrussativus and Cajanuscajanrepresentabundant nectar and pollen sources to Apisdorsata.

The region selected for the present study has good potential for sustaining beekeeping ventures because of the diversity of nectar and pollen taxa. Since Cajanuscajan, Lathyrussativus are major sources of forage for honey bees efforts should be made to increase. Their cultivation under social forestry like Prosopisjuliflora. 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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