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MELITTOPALYNOLOGICAL INVESTIGATIONS ON APIS CERANA AUTUMN HONEY COLLECTED FROM CHAMBA DISTRICT, HIMACHAL PRADESH

Pawan K. Attri
Institute of Integrated Himalayan Studies (UGC-Centre of Excellence)
Himachal Pradesh University, Summerhill, Shimla-5 (H.P)

ABSTRACT
Present research work mainly deals with the melittopalynological investigation of honey samples collected from different blocks of district Chamba with varied climatic conditions; Altitudes and Latitudes. In the present investigation, pollen analysis of thirty five honey samples extracted in autumn and early winter reasons from different localities has been made and their pollen components have been enumerated. Pollen analysis of honey samples revealed the following predominant sporomorphs, *Fagopyrum spp.,Plectranthus spp. , Saliva spp.* and *Roseceae spp.* in Bharmour valley up to Hadser to Holi and Durgathi *;Bauhinia spp.,Roseceae spp. and Saliva spp.* in dominant in all over the Bhattiyat area From Chowri khas to Sihunta ; *Fagopyrum spp.,, Saliva spp.* and *Roseceae spp.* in Chamba valley specially in Sillagharat to Chamba and north to proper Chamba. *Plectranthus spp.* and *Roseceae spp* predominant in Mehala area; *Fagopyrum spp. Labitae, Plectranthus spp.* and *Roseceae spp* in Salooni valley; *Asteraceae, Fagopyrum spp.,Labitae, Plectranthus spp.* and *Roseceae spp* in Tissa valley; *Fagopyrum spp., Labitae, Plectranthus spp.* and *Roseceae spp* in Pangi Valley. Thus out of thirty five honey samples seven were unifloral and twenty eight were multifloral.

KEYWORDS: Melittopalynology, Autumn honey, Chamba

INTRODUCTION

Beekeeping industry is one of the important agricultural and forest based rural industries in India. It is mainly involved in the production of commercial quantity of honey, using essentially colonies of the Indian hive bee, *Apis cerana*. Recognition and initial screening of various bee plants representing potential sources of nectar and pollen for the honey bees throughout the year, is an important pre-requisite for launching apiary industry in any locality.(Kalpana & Ramanujam, 1997)

Melissoplynological studies deals with microscopic analysis of the pollen contents of seasonal honeys and pollen loads from a locality. If it is supplemented with critical field studies involving phenology and floral biology, it provide reliable information regarding the floral types which serve as major or minor nectar and /or pollen sources for the honey bees. Further, these studies highlight various types of unifloral honeys that can be obtained in different seasons. It helps the beekeepers in the proper management of bee colonies during dearth periods. Because of varied nature of floral component, their associations and local spread, the pollen spectrum of a honey is also an expression of its geographical origin.(Ramanujam & Khatija, 1991). Beekeeping endeavor in Himachal Pradesh is still taken up on a modest commercial scale by beekeepers in some remote areas. Chamba district has great potential of beekeeping; however, reliable information on the bee plants, types of honey and nectar flow and dearth periods in this district is as yet highly limited and inadequate. Therefore, in the present Investigation, samples of honey were collected from *Apis cerana indica* F. colonies located in different parts of district having different Altitudes, Latitudes and climatic conditions. Honey samples were collected from all Block of Chamba district *i.e* Bharmour, Bhatyati,Chamba, Mehala, Salooni, Tissa and Pangi in the years from 2001 to 2005.

STUDY AREA

Nestling in the bosom of the Himalaya, Chamba district of Himachal Pradesh is unique in all aspects. Situated in the extreme north- west of the state of Himachal Pradesh, Chamba district is stretched between the upper Ravi (Vedic name-Purusni) valley and Chandra-Bhaga (Vedic name-Asikni) valley between North Latitude 32°10' and 33°13' and East Longitude 75°45' and 77°33' with an estimated area of 6,92,419 hectare. The district is surrounded on all sides by lofty hill ranges and the altitude in this entire mountainous territory ranges between 2,000 and 21,000 feet above sea level. The climate is warm, rainy season is well marked, the winter is mild and the snowfall is light (Table:**1**).

METHODOLOGY

For present melittopalynological investigations of 35 honey samples were done which collected from *Apis cerana indica* F. colonies located in different altitudes, latitudes and climatic conditions from different parts of district Chamba(Table:1**)**. These honey samples were collected from Chamba, Mehala, Bharmour, Bhatyati, Churah, Salooni and Pangi Block of Chamba district in Autumn season from 2001-2005. Pollen slides of honey samples were prepared using the method of Loureaux *et al.* (1978). The pollen grains obtained from honey samples

were identified and compared with the reference slides made from identified plants and from standard works of Erdthman (1960) and Nair (1964, 1985) and Uma Partap (1997). The absolute pollen count and percentages of pollen types in each samples were calculated (Vorwohe, 1981, Chaturvedi 1983) on the basis of total number of pollen grain counted in each sample. The pollen spectra were constructed on the basis of these percentages. Honey samples having 45% or more grains of a single pollen type were termed as "unifloral honey" and those having several pollen types in considerable percentage were termed as "multifloral honey" following Imama and Melhem (1979) and Chatuvedi (1983). For the presentation of frequencies of pollen grains in honey, the system adopted by Louveaux *et al.* (1978) was used. The following terms have been used in estimates of pollen grain frequencies. "Vary frequent" for grains constituting more than 45% of the total, "Spordic for grain constituting less than 3% ,"Predominant pollen" (more than 45% of the pollen grains counted): Secondary Pollen (16-45%), important minor pollen (3-15%), Minor pollen (less than 3%) The honey samples were considered rich, poor and extremely poor in pollen based on the number of pollen grain per 1 gm of honey samples, it was above 1,00000, 20,000 and below 20,000 respectively (Maurizo, 1975).

RESULTS & DISCUSSION

Himachal Pradesh is one of the important state in India that has a good potential of indigenous beekeeping. Melittopalynological investigation of 35 honey samples collected during the second major honey flow period (Sept-Oct) was light amber to brown in colour (Table:2).

Bharmour Honey: The honey samples of the second major honey flow were light amber in colour. The pollen sediment was poor in pollen. This was unifloral honey and four of pollen type ware predominant. i.e. *Fagopyrum spp.(24.11%), Plectranthus spp.,(45.25%) Saliva spp.(16.21%)* and *Roseceae spp.(12.12%)* Secondary and minor pollen were of *Abelmoschus* (Malvaceae 1.20%), *Capsicum anvum* (Solanaceae 3.6%), *Coriandrum sativum* (Apiaceae 2.40%), *Cucumis spp., Cucurbita maxima* (Cucurbitaceae 2.40%), *Fagopyrum esculentum* (Polygonaceae 1.20%), *Phaseolus vulgaris* (Papilionaceae), *Vigna spp.* (Fabaceae), *Cosmos sulphureus* (Asteraceae), *Delonix regia* (Caesalpiniaceae 1.20%), *Alnus spp*. (Betulaceae 2.40%), *Asparagus adscendens, Asphodelus spp.* (Liliaceae 1.25%), *Cannabis sativa* (Cannabinaceae 1.20%), *Carum carvi* (Umbelliferae 1.20%), *Chenopodium album* (Chenopodiaceae 1.20%), *Dioscorea Bulbifera* (Dioscoreaceae 2.40%), *Plectranthus rugosus, Thymus serphyllum* (Labiatae 3.61%), *Potentilla spp*. (Rosaceae).

Bhattiyat Honey: The honey samples of the second major honey flow (September to October) were brown in colour. The pollen sediment was poor in pollen. This was multifloral honey with no pollen type predominant except some pollen i.e. *Bauhinia spp.*,(10.14%),*Roseceae* (10.80%)and Salvia *spp.*(20.75%). Secondary and minor pollen were of *Abelmoschus, Hibiscus rosa-sinensis , Gossypium spp*. (Malvaceae 1.30%), *Capsicum anvum* (Solanaceae), *Coriandrum sativum* (Apiaceae 1.50%), *Hehianthus annuus, Cosmos sulphureus* (Asteraceae), *Oryza sativa, Bambuse berabos* (Poaceae), Solanum spp. (Solanceae), *Tirifolium alexandrinum* (Papilionaceae), *Citrus psedolimon* (Rutaceae), *Musa sapientum* (Musaceae 1.30%), *Callistemon citrinus* (Myrtaceae), *Delonix regia* (Caesalpiniaceae), *Impatiens balsamina* (Balsaminaceae 1.30%), *Acacia catechu* (Mimosaceae), *Adhatoda vasica* (Acanthaceae 1.33%), *Eucalyptus spp.* (Myrtaceae), *Prinsepia utils* (Rosaceae), *Ricinus communis* (Euphorbiaceae), *Rumex spp.* (Polygonaceae), *Tilia spp.* (Tiliaceae).

Chamba Honey: The honey samples of the second major honey flow(September to October) were brown in colour. The pollen sediment was poor in pollen. This was multifloral honey with no pollen type predominant except *Fagopyrum spp*.(11.27%),*Roseceae*(20.2%), *Salvia spp*.(19.16%) Secondary and minor pollen were of *Abelmoschus, Hibiscus rosa-sinensis, Gossypium spp*.(Malvaceae 1.94%), *Capsicum anvum* (Solanaceae), *Coriandrum sativum* (Apiaceae 0.97%), *Hehianthus annuus, Cosmos sulphureus* (Asteraceae), *Oryza sativa, Bambuse berabos* (Poaceae 1.94%), *Solanum spp.* (Solanceae), *Tirifolium alexandrinum* (Papilionaceae), *Citrus psedolimon* (Rutaceae), *Musa sapientum* (Musaceae 0.97%), *Callistemon citrinus, Eucalyptus spp*. (Myrtaceae),*Delonix regia* (Caesalpiniaceae), *Impatiens balsamina* (Balsaminaceae), *Acacia catechu* (Mimosaceae), *Adhatoda vasica* (Acanthaceae), *Amaranthas spinulosus, Cedrus deodara, Chenopodium album, Ipomoea purpurea, Prinsepia utils Prunus cerasoides* (Rosaceae), *Tagetus spp*.

Mehala Honey: The honey samples of the second major honey flow (September to October) was brown in colour. This was multifloral honey with *Plectranthus spp(26-04%). & Roseceae*(16.85%) pollen types were predominant. Secondary and minor pollen were of *Capsicum anvum* (Solanaceae), *Coriandrum sativum* (Apiaceae), *Helianthus annuus* (Asteraceae), *Raphanus sativus* (Braesicaceae), *Tirifolium alexandrinum* (Papilionaceae), *Citrus psedolimon* (Rutaceae), *Cosmos sulphureus* (Asteraceae), *Delonix regia* (Caesalpiniaceae 3.57%), *Adhatoda vasica* (Acanthaceae 1.19%), *Ipomoea purpurea* (Convolvulaceae 1.19%), *Bambuse berabos* (Poaceae), *Eucalyptus spp.* (Myrtaceae), *Prinsepia utils* (Rosaceae), *Prunus cerasoides, Ricinus communis* (Euphorbiaceae 2.38%), *Hypericum perforatum* (Hypericacaeae 1.19%).

Salooni Honey: The honey samples of the second major honey flow (September to October) was brown in colour. The pollen sediment was poor in pollen. This was multifloral honey with *Fagopyrum spp.(*21.27%),*Labitae (*10.5%),*Plectranthus spp*.(15.31%)and *Roseceae*(17.02%) pollen type ware predominant. Secondary and minor pollen grains were of *Abelmoschus* (Malvaceae), *Capsicum anvum* (Solanaceae), *Coriandrum sativum* (Apiaceae), *Cucumis spp. Cucurbita maxima* (Cucurbitaceae), *Fagopyrum esculentum* (Polygonaceae), *Phaseolus vulgaris* (Papilionaceae), *Vigna spp.* (Fabaceae), *Cosmos sulphureus* (Asteraceae), *Cedrus*

deodara (Pinaceae), *Gentiana spp.*(Gentianacaeae), *Rhus javanica* (Anacardiaceae), *Delonix regia* (Caesalpiniaceae), *Alnus spp.* (Betulaceae), *Asparagus adscendens, Asphodelus spp.* (Liliaceae).

Tissa Honey; The honey samples of the second major honey flow was brown in colour. The pollen sediment was poor in pollen. This was multifloral honey and *Asteraceae*(13.95%), *Fagopyrum spp*.(19.35%), *Labitae* (13.37%), *Plectranthus spp.*(22.62%) *Roseceae*(11.03%) pollen type ware predominant. Secondary and minor pollen grains were of *Abelmoschus* (Malvaceae), *Capsicum anvum* (Solanaceae), *Coriandrum sativum* (Apiaceae), *Cucumis spp. Cucurbita maxima* (Cucurbitaceae), *Fagopyrum esculentum* (Polygonaceae), *Phaseolus vulgaris* (Papilionaceae), *Vigna spp.* (Fabaceae), *Cosmos sulphureus* (Asteraceae), *Cedrus deodara* (Pinaceae), *Gentiana spp.*(Gentianacaeae), *Rhus javanica* (Anacardiaceae), *Delonix regia* (Caesalpiniaceae), *Alnus spp.* (Betulaceae), *Asparagus adscendens ,Asphodelus spp.* (Liliaceae).

Pangi Honey; The honey samples of the second major honey flow was brown in colour. The pollen sediment was poor in pollen. This was multifloral honey and Fagopyrum spp. (10.05%), Labitae(11.45%),Plectranthus spp. (25.04%),Roseceae (18.53%) pollen type ware predominant. Secondary and minor pollen were of *Abelmoschus* (Malvaceae), *Capsicum anvum* (Solanaceae), *Coriandrum sativum* (Apiaceae), *Cucumis spp. Cucurbita maxima* (Cucurbitaceae),*Cosmos sulphureus* (Asteraceae), *Fagopyrum esculentum* (Polygonaceae), Phaseolus vulgaris (Papilionaceae), *Vigna spp.* (Fabaceae), *Cosmos sulphureus* (Asteraceae), *Cedrus deodara* (Pinaceae), *Rhus javanica* (Anacardiaceae) ,*Delonix regia* (Caesalpiniaceae), *Alnus spp.* (Betulaceae), *Asparagus adscendens ,Asphodelus spp.* (Liliaceae), *Prinsepia utils* (Rosaceae), *Prunus cerasoides.*(Pia diagram: A - G) Thus out of thirty five honey samples seven were unifloral and twenty eight were multifloral. Seethalakshmi (1980) and Chaturvedi (1983) also observed uniflorality and multiflorality in various honey samples. Uniflorality and multiflorality in honey samples have been reported from different parts of the country i.e. Punjab, Kashmir, Uttar Pradesh, Maharashtra and Himachal Pradesh. It is considered to be good honey,the study include: Atwal *et al.*,1970;Chaturvedi,1976,83,89; Chaubal,1980; Mohana Rao & Suryanarayana, 1983; Singh, 1983; Nair, 1964, 1985;Sharma & Gupta, 1997; Lakshmi & Suryanarayana, 1997; Singh,1999; Ramanujan & Khatija,1990; Kalpana & Ramanujam,1990;Joshi *et al.*,1998; Lakshmi & Suranarayana, 1997; Agashe & Rangaswamy, 1997; Mattu *et al.*, 1988; Singh & Suryanrayana, 1997; Kumar & Kashyap, 1996; Jhansi *et al.*, 1991; Sharma,1989; Sadruddin & Tripathi,1985; Kumar & Kumar, 1989 and Gaur & Nanwani, 1989.Beekeeping is a minus pollution industry, that means, it is not only pollution free activity but also, in its totality, being vegetation loving occupation, helps prevent pollution created by other industrial activities. As in the case of all other industries beekeeping too causes multi-pronged employment generation. The added advantage is that it basically creates employment through small and household rural enterprises. Indeed, if organized properly, it has the potential of preventing the out flow of rural folk from villages towards cities. Beekeeping is a traditional activity in most of the areas of district Chamba. The bee flora is not uniformly spread over all areas. It is either concentrated in and around forests or suitable cropped areas or orchards and has long seasonal gaps. Therefore, melittopalynological investigation is a evaluation of plants for their utility as sources of bee forage. It provides the information needed to assess the potential for beekeeping in an area. Melittopalynological studies are thus helpful in bee management and in promoting beekeeping development.

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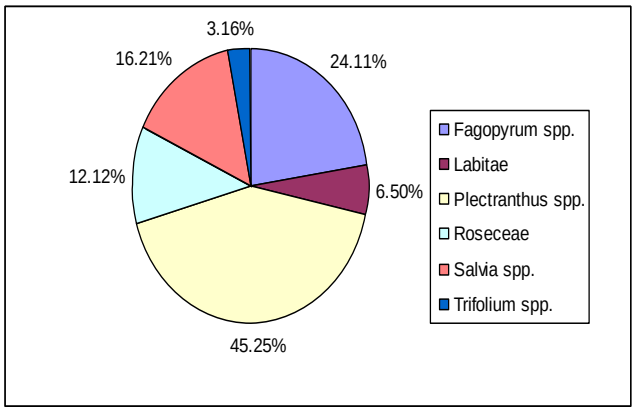
Table .1. Physiographic details of various areas of collection of honey samples of *Apis cerana indica* F. of District Chamba

S.No	Areas	Latitude	Longitude	Altitude (in meters)
1	Bharmour	32° 26′ N	76° 31′E	1392- 2358 M
2	Bhattiyat	32° 12′ N	75° 50′E	1107-1357M
3	Chamba	32° 11′N	75° 49′E	1005-1225 M
4	Salooni	32° 45′N	76° 05′E	1098-1349 M
5	Tissa	32° 50′N	76° 10′E	1558-1835 M
6	Mehala	32° 28′N	76° 11′ E	1600-1825M
7	Pangi	33° 05′N	76° 24′E	2134-2591 M

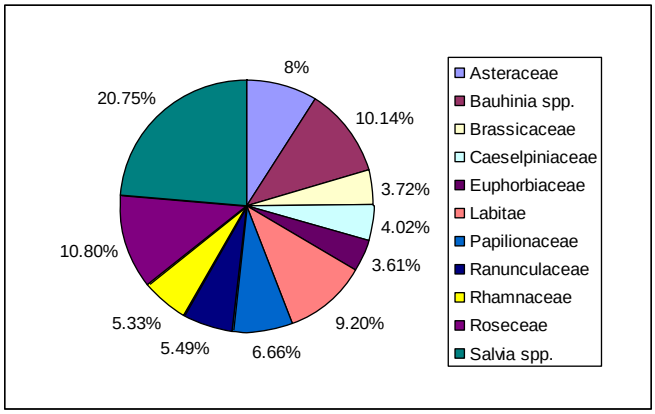
Table: 2. Frequency distribution of Pollen types in autumn honey of *Apis cerana indica* F. collected from different Blocks of District Chamba.

S.No.	Plant species	Availability						
		Bharmour	Bhattiyat	Chamba	Mehala	Saloon i	Tissa	Pangi
1.	*Alnus spp.*	1.20	–	–	–	2.19	1.16	–
2.	Apiaceae	2.40	–	1.18	–	–	–	–
3.	*Aster spp.*	–	–	1.56	–	–	–	–
4.	Asteraceae	–	8	6.50	9.52	9.89	13.95	8.45
5.	*Bauhinia spp.*	–	10.14	1.18	1.94	–	1.16	–
6.	Brassicaceae	–	3.72	2.81	3.57	–	–	–
7.	Caeselpiniaceae	–	4.02	–	4.57	2.19	1.16	2.81
8.	Euphorbiaceae	–	3.61	–	2.38	–	1.16	2.75
9.	*Fagopyrum spp.*	24.11	–	11.27	–	21.27	19.35	10.05
10.	Iridaceae	–	–	–	–	–	–	–
11.	Labitae	6.50	9.20	6.60	9.20	10.05	13.27	11.45
12.	Malvaceae	–	1.30	1.94	–	1.09	1.16	–
13.	Papilionaceae	2.92	6.66	1.95	–	5.49	8.13	7.04
14.	Poaceae	1.20	2.60	–	2.38	1.09	–	–
15.	Polygonaceae	–	1.30	–	2.32	2.87	–	–
16.	*Potentilla spp.*	1.13	–	–	–	2.02	–	3.81
17.	*Plectranthus spp.*	45.25	–	–	26.04	15.31	22.62	25.04
18.	*Prinsepia spp.*	–	–	–	–	4.05	2.75	3.75
19.	Ranunculaceae	–	5.49	–	8.04	3.29	2.32	5.32
20.	Rhamnaceae	–	5.33	–	7.14	–	–	–
21.	Roseceae	12.12	10.80	20.2	16.85	17.02	11.03	18.53
22.	*Rumex spp.*	–	3.12	12.11		1.09	1.94	–
23.	Salicaceae	–	–	–	1.19	–	–	–
24.	*Salix spp.*	–	1.30	1.24	–	–	–	–
25.	*Salvia spp.*	16.21	20.75	19.16	4.76	3.28	1.16	1.09
26.	Solanaceae	–	–	–	–	–	–	–
27.	Tiliaceae	–	2.66	1.94	2.04	–	–	–
28.	*Trifolium spp.*	3.16	–	–	–	–	–	–

Pie diagrams A & B showing pollen spectra of some autumn honey samples from Bharmour & Bhattiyat blocks of district Chamba (H.P.)

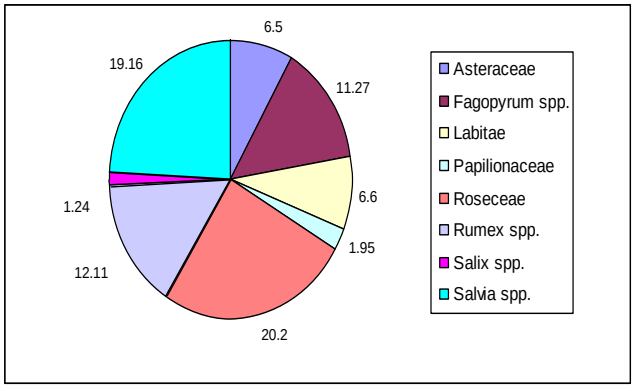


Bharmour

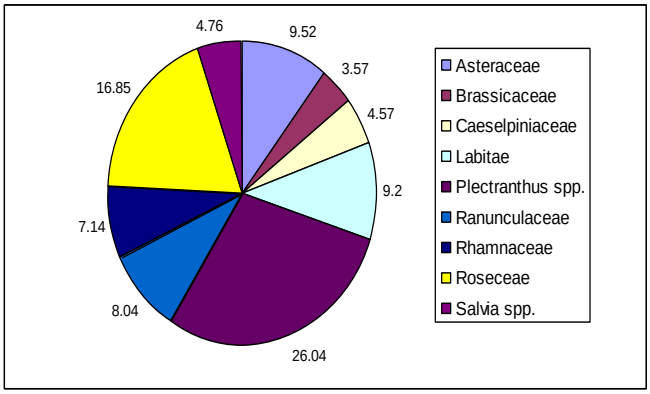


Bhattiyat

Pie diagrams C & D showing pollen spectra of some autumn honey samples from Chamba& Mehala blocks of district Chamba (H.P.)

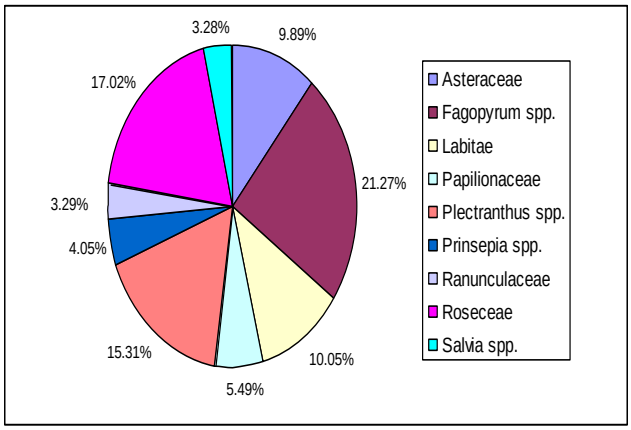


Chamba

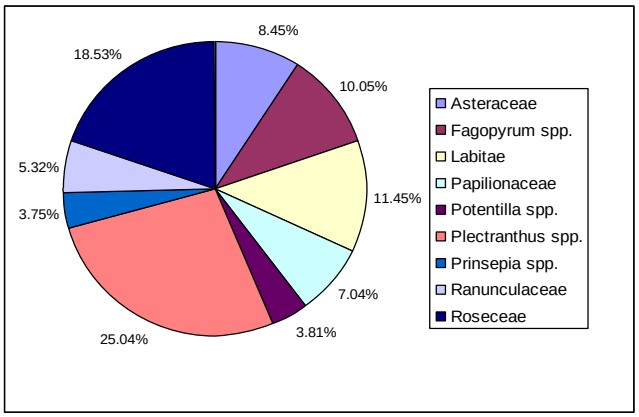


Mehala

Pie diagrams E & F showing pollen spectra of some autumn honey samples from Salooni & Tissa blocks of district Chamba (H.P.)

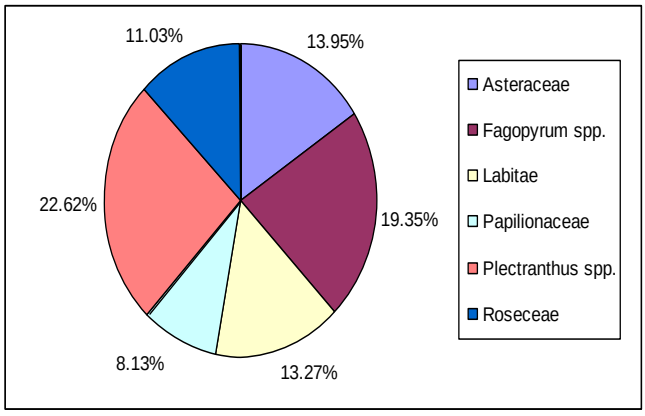


Salooni



Tissa

Pie diagrams G showing pollen spectra of some autumn honey samples from Pangi block of district Chamba (H.P.)



Pangi