MELISSOPALYNOLOGICAL STUDIES IN AND AROUND MOKOKCHUNG DISTRICT

BY
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DEPARTMENT OF BOTANY

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CERTIFICATE

This is to certify that the accompanying thesis entitled "Melissopalynological Studies In And Around Mokokchung District" submitted in fulfillment of requirements for the award of the Degree of Doctor of Philosophy in Botany, by Miss. Temsunungla contains a bonafide research work carried out by her at Nagaland University, Lumami.

Further, certified that no part of this thesis has been submitted anywhere for any other degree or diploma. The assistance and help received during the course of study by the candidate and source of literature have duly been acknowledged. This thesis embodies the work of candidate herself.

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CERTIFICATE

This is to certify that the present Thesis entitled "Melissopalynological studies in and around Mokokchung District" submitted as the partial fulfillment for obtaining the degree of Doctor of Philosophy in Botany of Nagaland University, is an original piece of work carried out by me for the first time. None of the portion or portions of this work i.e., photographs, figures or tables has been copied or reproduced from anywhere else.

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Temsunungla

CONTENTS

INTRODUCTION

INTRODUCTION

"Melissopalynology is the branch of palynology deals with the study of pollen content in a particular honey sample".Over hundred years the literature pertaining to the study of pollen in honey has been termed or spelled several ways including melissopalynology, Mellittopalynology and melittopalynology . According to panton`s Botanical dictionary (1868) both "Melissa" and " melitta" means a 'Bee". The word "melliferous" comes from the Latin word "melifer" means honey and the suffix-ous meaning "having full off" or characterized by (Bryant, 2001). The International Commission for Bee Research (ICBR) uses the term "Melissopalynology" for the study of pollen and honey, which is the term used throughout this thesis.

The Honey

For survival, honey bee require four natural resources, viz., Water, resin, nectar and pollen (Seedley, 1985). Water is used to cool the hive and to dilute the honey fed to the young broods. Resin is utilized to repair the hive e.g., sealing of decaying wood and to plug up holes. Nectar is the major source of carbohydrates from which honey bee obtain their energy. According to Winston (1987) it can be fed directly to the brood or to the adults. The nectar is collected by the workers bees in their honey stomachs and it is usually transferred to hive workers for processing into honey. These workers add an enzyme, to this nectar, which is secreted by their hypopharyngeal glands. This enzyme breaks down the

nectar into simple forms of sugars, which are easier for the bees to digest. These enzymes protect the stored honey from bacteria. The water in the nectar is then evaporated off of the worker's tongue. The nectar is placed into cells and fanned to further reduce water in it. According to Winston (1987), this process reduce the moisture content of nectar less than 18% . Once the evaporation process is complete, the nectar is considered "ripenedquot " and is called honey. This honey is stored in the cells of the honey comb and is capped with wax.

It has been estimated that to make one pound of honey, honey bees must visit about two million flowers, fly a total of about 50,000 miles and carry about 73,000 loads of nectar back to the hive According to Teale (1942), during the main blooming periods it is common for the bees from a single hive to visit as many as 2,50,000 flowers during the course of a single day. Winston's (1987) studies reveal that each worker bee is able to carry a load of nectar equal to one - half its total weight and during its lifetime one worker will collect enough nectar to produce about 1/12 of a teaspoon of honey. During foraging, a honey bee consumes 0.5 mg of ripe honey per kilometer of flight. Feeding a bee larva from the egg to maturity requires about 142 mg of honey.

SOURCE OF POLLENS IN HONEY

According to Gary (1975) pollen is the major source of proteins, fatty substances, minerals and vitamins for honey bees. Pollens are essential for the growth of larvae and young adult bees (Dietz, 1975). The pollen

grains are collected by honey bees from the anthers of flowers by using their tongue and mandibles. At the time of nectar and pollen collection, body parts of honey bee are sprayed with pollen grains. These pollen grains are combed and mixed with pollen from her mouth and transferred it to the corbicula, or "Pollen – basket" on her posterior pair of legs. At hive, worker bees pack the pollen into the comb. To prevent bacterial growth and pollen germination a phytocidal acid is added to the pollen as it is packed into the comb. Other enzymes produced by worker bees are also added which prevent anaerobic metabolism and fermentation, thereby, enhancing the longevity of the stored pollen. The completely processed pollen grains for storage kept in comb is referred to as "bee bread " and is ready for later consumption by the bees. According to Alfonsus (1933), the protein source needed for rearing one worker bee from larval to adult stage require approximately 120 to 145 mg of pollen. An average size bee colony will collect about 20 to 57 kg of pollen a year (Armbruster 1921, Eckert,1942).

The pollen grains are collected from entomophilous as well as anemophilous plants also. However, according to Bryant (2001) wind pollinated species of *Salix* (Willow), *Quercus* (Oab), *Celtis* (hach berry) and many species of grasses (Poaceae) as well as some of the wind – pollinated type of composites (Asteraceae) are considered important pollen sources for foraging by honey bees. Airborne pollen is another potential source of pollen in honey. Many types of airborne pollen produced mostly by wind – pollinated plants that are not usually visited by honey bees can enter a hive through wind currents. But the number

of airborne pollen grains are usually few in number. Mostly the airborne pollen can settle out in areas where open comb cells are being filled with nectar.

Importance of Melissopalynological Studies

Pollen is an essential tool in the analyses of honey. The floral nectar source utilized by honey bees for honey production can be determined by the identification of pollen taxa (Lieux, 1975, 1978 ; Moar, 1985; Louveaux *et al* 1970; Sawyer, 1988; Van Der Ham *et al,* 1999). Thus, the relative pollen frequency is often used to verify and label a honey sample as to the major or minor nectar sources. Identifying and quantifying the pollen in honey samples is one of the best ways to determine the range of nectar types used to produce a honey and therefore label it correctly based on actual foraging resources. Another most important reason that pollen analysis of honey are often required is to identify the geographical source of origin as well as assessment of phytogeography of the region. The combination of anemophiles and entomophiles found in a honey sample will often produce a pollen spectrum that is unique for the specific geographical region where it was produced. Trade agreements, import tariffs and legal trade restrictions require accurate labeling of honey before it can be sold in the market of leading honey producing nations of the world. However, in India no such rules and regulations are strictly followed for the honey trade and lead to the adulteration of the honey with sugar syrup.

Unifloral and Multifloral honey

After experimental investigation on European honey for thirteen years Demianowicz (1961, 1964) realized that the relative pollen count in honey did not always reflect the primary floral and nectar sources. Demianowicz (1964) attempted to identify the pollen characteristics of 45 different types of unifloral honey that are common to various regions of Europe. For her experiments she used small bee-hive with one queen and 300-400 workers. These bees were allowed to feed on the flowers of only one species of plant. She extracted the honey of each hive and considered it for absolute pollen concentration (APC) for the flower type being tested. On the basis of her experiments she developed 18 different categories of plants with respect of their APC values in honey are under or over represented. Thus, for each category she assigned an "average number" that she called her " Pollen Co-efficient Classes". According to this pollen co-efficient value could be used as a guide for determining the true unifloral nature of a honey sample , irrespective of the data represented by the relative pollen concentrations.

Demianowicz's Class 1 unifloral type should contain not more than 740 pollen grains per 10 gm of honey. In this class she kept *Asclepias* (milkweed) with pollen co-efficient value 32. Each additional class should have APC values that are upto twice as high as the previous category. In her Class 2 of unifloral honey types the APC value should be between 750-1500 per 10 gm of honey. In this category

she kept *Robinia pseudoacacia* (white acacia, locust), *Cucumis* (cucumber) and *Epilobium* (Fireweed). In Class 18 with prolific pollen types she kept *Myosotis* (Forget –me-not) which produced nearly 200 million pollen grains per 10 gm of honey.

A number of scientists have produced tables and charts noting what they believe should be the "expected" percentages of relative pollen in unifloral types. In New Zealand, Moar (1985) points out that since 45% of a single pollen type is the universal " minimal" amount needed for a honey to be classified as unifloral. However, according to Sawyer (1981,1988) if the pollen grains of a particular plant species are 45% of the total pollen count in honey sample, the honey sample should be called "unifloral" and if none of the plant species, represented through the pollen in a particular sample, reaches upto 45%, the honey should be called as " multifloral".

Review of Literature

First of all the pollen contents of various Swiss, French and other Europeans honey was examined by Pfister (1895). He tried to demonstrate the possibility of determining the geographical origin of honey from the pollen within it. The first published report on the pollen content of honey from United States of America is by W.J.Young at the beginning of twentieth century. He published a paper in 1908 to determine if pollen studies could be used in the future to "Judge the adulteration of a sample" (Young, 9108). Based on his work, Young determined that the range of pollen concentration values varied from a

low of 123 pollen grains / g to a high of 5,410 grains commonly found in U.S. honey and discussed the importance of protecting honey samples from airborne contaminants. He also reported the presence of insect body parts, fragments of the comb, Fungal spores, dust, pollen etc. in honey. The first European, who published his work on Melissopalynology was Fehlman. Fehlman (1911) published report on the pollen spectra found in various examples of Swiss honey (Maurizio, 1951 ; Maurizio and Louveaux, 1965; Lieux,(1969). He was the first European to use pollen as a way to identify and differentiate honeydew from nectar honeys and to demonstrate that pollen contents were the key to determine the nectar sources in honey samples. In United States it was Parker (1923) who conducted a study of bees and the honey they collect. He described 28 different kinds of pollen grains collected by honeybees and included photographs of the 12 most important ones. He was convinced that the pollen content in honey was a valuable tool for identifying the foraging sources used to make it.

Betts (1923, 1925) worked on English honey and published sketches of 15 different kinds of pollen sources found in it. She suggested that flowers from herbarium specimens could be used as a source of pollen to make comparative reference samples. A few years later, Allen (1928a) noted that same pollen grains remain on the surface of the honey, instead of becoming mixed with the honey like other types of pollen. He was also the first to report that pollen found mixed with nectar could come from sources other than the nectar plant's own anther and pollen (Allen, 1928b). He had also reported

floating pollen grains on the surface of honey and reasoned that due to their lesser density than honey some pollen grains float on its surface. Allen (1928, a, b) also noted that air borne pollen grains could easily contaminate honey when combs were being removed from hives and also during the subsequent honey extraction process. But according to him contamination of honey through air borne pollen is a minor problem and pollen in honey mostly reflects the actual floral sources used to make the honey. However, Allen (1929) was the first researcher to focus some of the problems of conducting accurate melissopalynology analyses. He also emphasized the difficulties of pollen identification in melissopolynology (Allen, 1928 a, b; 1929). His most valuable contribution is proposed classification system for English honey. However, his remark regarding English honey which states that " One should doubt the origin of a honey sample as being English if the sample contains six – grooved pollen grains" has been disapproved by Bryant (2001) on the bases that many Lamiaceous taxa such as *Mentha* (mint) , *Thymus* (thyme) and *Salvia* (Sage) are now grow in English garden and foraged by the honey bees. The foundation of melissopalynological research in Europe was laid down by the five volume work of Zander (1935, 1937, 1941,1949,1951). In these volumes he has described descriptions, drawings and photographs of pollen that he found in various types of European honey. He also described fungal spores and hyphae from honey samples. His voluminous work on English melissopalynology has brought him the honours to be called as "leader in melissopalynology research in Europe" by Maurizio and Louveaux (1965).

In United States, Pellett (1930) and Pammel *et al* (1930) published "American honey plants and "Honey plants of Iowa " respectively. However, there is no other report of melissopalynological research in United States during this period i.e.1930s. Later, Oertel (1939) published the results of his seven – year study on the sources and blooming periods of plants though to be principal honey bee nectar sources in various regions of the United States (Bryant, 2001).

Whitcomb and Wilson (1929) studied the cause of dysentery in honey bees and reported that many of the pollen grains sucked into a bee's honey stomach along with nectar were quickly removed through a process of filtering. These authors reported that once nectar reaches a bee's honey stomach it is filtered within 10 minutes and only pure nectar is left in honey stomach. These authors concluded that the filtering of nectar in their honey stomach is a device to remove unwanted pollen and fungal spores so as to prevent future honey from pollen and spore germination. But, Snodgrass and Erickson (1992) have described the process of nectar filteration in detail. However, due to filteration of nectar, lots of pollen grains and fungal spores and other unwanted plant products e.g. hairs etc., are also defecated by these bees in bulk which is called "Yellow Rain" and this phenomenon comes in the form of small yellow spots on cars, buildings, leaves of plant etc.

Todd and Vansell (1942) published their work on the relationship and importance of pollen in honey at United States Department of Agriculture (USDA) California. These workers found that honey bees do not reproduce or lay eggs if feed on sugar syrup only

but if the pollen were added to the feeding syrup, egg laying in the hive started within twelve hours. These workers also made qualitative and quantitative melissopalynological studies of over 2,600 samples of nectar collected from various apiaries in California.

Recently, hundreds of papers have been published on the melissopalynological studies in Europe and USA for maintaining the quality of honey. Although, in India the uses of honey are multifarious as it is used in various rituals by Hindu communities right from the birth of the child up to the death, yet , the measures taken to control the quality of honey are not sufficient. The literature on melissopalynological studies in India is also meager.

In India during 1950's onward Deodikar et al. (1958) and Chaubal and Deodikar. (1965) have reported melissopalynological data from Mahabaleshwar and Western ghats respectively. These workers have reported major honey yielding plants from the invetigatd regions. However, Chaubal (1980) reported that most of the pollen grains in honey comes from member of Acanthaceae and Compositae and emphasized a need of preparing a critical palynological data for most of the members of Acanthaceae (Chaubal *Deodikar*,1965; Chaubal 1966) and Compositae (Chaubal *and Deodikar*. 1966 – 1967; Chaubal, 1976), to facilitate the identification of pollen from loads and honey samples especially from Western ghats of India. However, during their studies Chaubal and Deodikar, 1963; Deodibar *et al.* 1958 B ,1958 C) have also reported occurrence of poisonous pollen grains in honey samples collected from plains of Sayhadri, but such poisonous pollen grains did

not occur in the samples of Sagarmal region of Kolhapur district of Maharashtra, India (Chaubal, 1980)

During 1970's the melissopalynological studies have geared up and at NBRI, Lucknow, Nair, 1964; Sharma, 1970; Chaturvedi, 1973, 1983, 1989; Garg and Nair, 1994; Garg, 1996), have also published a few reports of melissopalynological studies in that region of India.

At the Department of Botany Allahabad University, Chaturvedi (1983) have enlisted several plant species visited by honey bees for pollens only, for nectar only and for pollen and nectar both. His work is based on the field survey and observations in and around Allahabad district (Chaturvedi, 1993; Chaturvedi and Chaturvedi,2001). In India, other centers for melissopalynological studies include North Bengal University (Department of Botany), Allahabad University (Department of Botany), Bangalore University (Department of Botany), Dr. B.R.Ambedkar University, Agra (Department of Botany), Haryana Agriculture University, Hisar, Manipur Agriculture University, Imphal and certain NGO's like Century foundation, Bangalore, Bioved Research And Communication Society, Allahabad are engaged in similar type of investigations.

In Nagaland, Chaturvedi and Temsunungla (2004) have published first hand report of melissopalynological studies and concluded that seasonal honey samples, collected during winter and autumn,from the bee hive of *Apis indica* (The native Indian honey bee) kept in the CTC campus of Ungma village of Mokokchung district, varies in the frequency of pollen grains and the colour of the honey. Winter samples

of honey exhibits 50.81 % of Asteraceous pollen, whereas Autumn samples show maximum number of poaceous pollen grains i,e. 23.34 %.

The present investigation deals with the melissopalynological studies of seasonal honey samples collected from three villages viz., Khensa, Kubza and Ungma, of the Mokokchung district in Nagaland State, (Maps : 1 – 3).


INDIA
States and Union Territories
N
JAMMU & KASHMIR
Srinagar
HIMACHAL PRADESH
Shimla
PAKISTAN
Chandigarh
PUNJAB
UTTARANCHAL
Dehradun
DELHI
HARYANA
CHINA (TIBET)
ARUNACHAL PRADESH
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Panaji
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KARNATAKA
Bangalore
LAKSHADWEEP
Chennai (Madras)
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KARAIKAL (Pondicherry)
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Map not to Scale

MAP – 1


District Map of Nagaland
Mon
Mokokchung
Tuensang
Wokha
Zunheboto
Phek
Dimapur
Kohima
Map not to scale
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MAP – 2

MAP OF MOKOKCHUNG

MAP – 3

MATERIALS AND METHODS

MATERIALS AND METHODS

Melissopalynological studies involves various methodology such as collection of honey samples, collection of plant species for preparation of reference slides. Storage of honey samples, extraction of pollen grains, preparation of slides of pollen-grains, photomicrography and identification of pollen grain.

These methodologies are described as follows –

Collection of honey samples

Honey samples for the present investigation have been collected from three different localities, viz., CTC campus of Ungma village, Kubza village and Khensa village of Mokokchung District, Nagaland. For the collection of honey samples two seasons were selected, winter (January – February) and Autumn (August– September).

The samples were collected from the honey comb of the Apiary directly into the PVC 250 milliliters bottles which are temperature resistant and autoclavable. These samples were marked for the localities and date of collection and kept at room temperature in the laboratory at Botany Department, Nagaland University, Lumami for further investigation.

Storage of honey samples

The collected samples were stored in laboratory conditions at an ambient temperature ranges from **7°C - 16°C** during winter months with RH 20% - 60% and **16°C - 30°C** during summer months with RH 60% - 90% .

Extraction of pollen grains and preparation of slides from honey samples

There are various techniques for pollen extraction from honey samples as given by Sawyer (1981,1988), Ricciardelli D'Albore(1998), Lieux (1969), Bryant and Jones(2001), Barth *et al* (2004), Jones *et al* (1995), Ohe *et al* (2004), Louveaux *et al* (1978), Herrero *et al* (2002), Lutier and Vaissiere

(1993) and others and thus. However, for the present investigation, Sawyer's (1981) method has been modified and used for the pollen extraction from the honey samples. However, the methodology used for the present investigation is as follows –

(1). 10 grams of honey is mixed with 20 milliliters of hot water. After thorough mixing, the Solution is placed in two tubes and centrifuged for 10 minutes at 2500 rpm.

(2). The supernatant solution is decanted and the residue is transferred to one tube. Both are filled with water (to balance the centrifuge) and recentrifuged for 5 minutes.

(3). The liquid is decanted and the residue is transferred to a microscope slide using a micro-pipette and spread over two third of microscopic glass slides and dried. For Qualitative and quantitative melissopalynological analysis following methods which were used by Ohe *et al* (2004), were modified and used for the present investigation –

Processing of honey for the preparation of pollen slides

10 grams of honey) by weight have been taken in a 50 milliliters capacity pointed Glass centrifuge tube. 20 milliliters of distilled hot water (20°-40°k) was mixed so as to dissolve the honey. This solution was centrifuged for 10 minutes at 1000 rpm. The supernatant liquid was decanted. Again 20 milliliters of distilled water was added to the residue so as to dissolve the remaining crystals. Again this mixture was centrifuged for 5 minutes at 1000 rpm. The supernatant liquid was decanted and removed by placing the tube upside down at 45° angle. The excess liquid is allowed to be taken up by an absorbent paper.

The glycerin jelly (mounting medium) was liquified by heating it at 40° C on a heating plate. The glycerin jelly which has been taken for the mounting of pollen grains was prepared by adding some drops of 0.1%(w/v) sapanin ethanol solution (0.5-1 ml of this solution was added to 10 ml of fluid glycerin jelly). A water proof marker was used to draw a 22 x 22 mm square on the microscope slide and the slide put on the heating plate. The entire residue was mixed thoroughly with a Pasteur pipette and the entire residue was transferred on the slide. The residue was spread evenly with a thin glass rod over the marked 22 x 22 mm area. Now the slide is left on the heating plate only for the time strictly necessary to dry the residue. Some of the cover – slips (22 x 22 mm),Were warm up on the heating plate. One drop of glycerin jelly was taken and applied it on to the cover slip to form a large cross diagonally. Now the cover slip was placed on the slide very slowly to avoid air bubbles. The preparation was left on the heating plate for 5 minutes so that an even dispersion of glycerin jelly and uniform swelling of pollen grains take place. It should be kept in mind as precautionary measure that the drop of glycerin jelly should never be applied directly on the dried residue of pollen grains. During the whole procedure, great care has been taken to prevent contamination from foreign pollen, coming from either previous honey preparations or from air borne pollen grains.

Identification and counting of the pollen grains qualitative analusis

The examination under the microscope has been carried out at the magnification 400 x 1000x. First of all the types and density of pollen grains were determined and then relative frequencies of each pollen type are determined as follows –

Pollen grains were identified and counted in groups of 100 from 5 parallel equidistant lines uniformly distributed from one edge of the cover slip to the other. Abortive, irregular or broken pollen grains were also counted. Non identifiable or non-identified pollen grains were noted separately. Further, the fungal spores, hyphae and other microscopic elements were also noted down separately.

Calculation and reporting the result

As far as possible the pollen grains were identified upto family, genus and species level. For each type of pollen grain, relative frequency with respect to the total number of pollen grains was calculated as the respective percentage. For the determination of botanical origin of honey, the relative frequency of the pollens were recalculated by excluding the number of pollens of nectarless plants.

Interpretation of the results

For the identification of pollen types and the interpretation of pollen spectra a collection of reference pollen slides and photographic atlas were used as suggested by Maurizio and Louveaux (1965), Sawyer (1988), Ricciardelli d' Albore (1997,1998).

Determination of Botanical origin

The determination of the botanical origin of the honey has been categorized as unifloral (if the relative frequency of the pollen of the taxon exceeds 45%), otherwise it has been kept under the multifloral category.As ar as possible, pollens were identified upto spacing level but a few are left which could not be identified upto species level.

Methods of Quantitative Melissopalynological Analysis

The slides were prepared by using the same methodology as used for qualitative analysis.

In order to examine the surface uniformly, ten equidistant parallel lines in the field of objective were observed from an edge of the cover slip to the other.

Calculation , Expression And Interpretation of Results

The absolute number of pollen-grains in 10 gram of honey (PG/10 g) were calculated as follows –

$$PG / 10\,g = \frac{S \times npg \times 10}{s \times a \times p}$$

Where 'S' is the surface area (mm^2) of a part of the glass slide containing the sediments residue. 's' the area of one microscopic field at the magnification used (mm^2), npg is the total number of pollen grains (PG) counted.

Acetolysis Method For The Preparation Of Reference Slides

This method has been given by Erdtman (1960) and used for the preparation of reference slides of the identified taxa of the region for comparison. This method comprises with the following steps –

(i). Put the pollen material into a heat – resistant centrifuge tube and cover with 5 ml mixture of acetic anhydride and sulfuric acid (this mixture can be prepared by adding the acid, drop by drop, to nine times the volume of acetic anhydride).

(ii). Insert a glass rod to each centrifuge tube and transfer the tubes to a water - bath at 70° C if possible in a fuming chamber).

(iii). Heat the water – bath to boiling point, then immediately stop heating and stir the liquid in the tubes and transfer these to the centrifuge.

(iv). Centrifuge the mixture at 2500 rpm for 5 minutes, decant the reaction mixture into a reserve receptacle.

(v). Add 10 ml of water – alcohol mixture to the residue and shake the tube thoroughly.

After acetolysis and washing transfer about one third of the suspension from the centrifuge tube to another tube. Centrifuge and decant again, then add to the residue about 2 ml of glacial acetic acid (GAA), 1 or 2 drops of saturated sodium chlorate solution and finally 2

or 3 drops of concentrated hydrochloric acid. Stir the liquid with glass rod. By this reaction chlorine is produced immediately, and bleaching is usually obtained in a few seconds.

Again centrifuge the mixture, decant and wash it twice with distilled water. Then mix the suspensions of acetolysed pollen grains and of acetolysed and chlorinated pollen grains. After centrifuging and decanting once again suspend the residue in a few drops of a mixture of glycerin and water (1:1). Leave for at least 10 minutes, centrifuge, decant, then invest the centrifuge tubes on glass slides. Fix a drop of glycerin jelly on a needle, and carefully dip it into the pollen bearing sediment. Then transfer to a slide the jelly and the pollen material adhering to it. Cover with a carefully cleaned, very thin circular cover – glass (diameter, about 10 mm) or a square or rectangular cover – glass.

The margin of the cover slip should be sealed with melted paraffin. Then turn the slide up side down to allow small pollen fragments to settle close to the cover glass.

Stability of Preparations of Non – Acetolysed Pollen Grains

Pollen grains in reference preparations alter in the course of time. If the fatty oil is not removed from them, they become pale and the exine also losses colour. In all types of preparation the pollen grains increase in size, because of swelling. Old preparations are also useful as they show particular characteristics better than fresh ones, but they should not be used for comparing diameters.

OBSERVATIONS

OBSERVATIONS

WINTER SAMPLES

Kubza Village

Winter samples of honey obtained from Kubza Village of Mokokchung district reveal the presence of following types of pollen grains belonging to various members of respective families in the honey collected by the bees of *Apis indica*.The number of pollen grains is given per ml of honey sample.

Ranunculaceae - *Helleborous niger, Nigella, Clematis vitalba*, Magnoliaceae - *Magnolia grandiflora*, Brassicaceae - *Brassica napus*, Violaceae - *Viola tricolor*, Caryophyllaceae - *Stellaria media, Spergularia rupicola*, Cistaceae - *Helianthemum chamacistis*, Malvaceae - *Hibiscus rosa sinensis, Abutilon indicum,* Convovulaceae - *Convolvulus cantribrica,* Geraniaceae - *Geranium rotundifolium*, Balsaminaceae - *Impatiens glandulifera,* Rutaceae - *Citrus limon, Vitaceae - Parthenocissus tricuspidata,Vitis vinifera*, Hippocastanaceae - *Aesculus hippocastanum*, Anarcardiaceae - *Pistacia lentiscus*, Platanaceae - *Platanus orientalis*, Fabaceae - *Erythrina indica, Desmodium* sp, *Lupinus albus, Melilotus alba, Ononis pubescens, Ulex europacus, Ulex galli*, Caesalpinaceae - *Cassia didimobotrya*, Mimosoideae - *Acacia dealbata,* Rosaceae - *Prunus domestica, Prunus dulcis, Pyrus communis*, Crassulaceae - *Sedum acre*, Myrtaceae - *Myrtus communis, Eucalyptus gunii*, Passifloraceae - *Passiflora, edulis,* Cucurbitaceae - *Ecballium elaterium, Citrullus lanatus,* Apiaceae - *Bupleurum fruticosum,* Araliaceae - *Hedera helix*, Cornaceae - *Cornus sanguinea*, Asteraceae - *Ageratum conizoides, Arctium sp, Carduus sp, Carthamus sp, Cirsium sp, Eupatorium japonica, Helianthus annuus, Matricaria sp, Michenia micrantha, Senecia sp, Solidago canadensis, Xanthium strumarium*, Ebenaceae - *Diospyros kaki*, Oleaceae - F*raxinus excelsior*, Boraginaceae - *Cynoglossum creticum, Symphytum*, Convolvulaceae - *Convolvulus arvensis*, Poleminiaceae - *Phlox drummondii*, Scrophulariaceae - *Antirrhinum majus, Linaria vulgaris, Verbascum*

thapsus, Verbenaceae - *Verbena officinalis*, Lamiaceae – *Thymus sp, Lavandula angustifolia, Rosmarinus sp, Teucrium sp*, Plantaginaceae - *Plantago lanceolata*, Polygonaceae - *Fagopyrum esculentum*, Lauraceae – *Laurus sp*, Thymelaceae - *Daphne gnidium*, Elaeagnaceae - *Hippophae rhamnoide*, Loranthaceae – *Loranthus sp*, Euphorbiaceae – *Chrozophora sp*, Urticaceae - *Urtica dioica*, Ulmaceae - *Ulmus procera*, Betulaceae - *Alnus glutinosa*, Fagaceae - *Querus robur*, Musaceae - *Musa paradisiaca*, Iridaceae - *Iris unguicularis*, Liliaceae – *Allium cepa* , *Asparagus acutifolius*, Smilaceae - *Smilax aspera*, Poaceae - *Alopecurus pratensis*, Pinaceae - *Pinus insularis*, Cupressaceae - *Cupressus sempervirens*.

Plate - 1 Figure - 1

Genus – *Helleborous* Species - *niger*
Shape – *Irregularly round*
Size – *35* µ
Pore / colpi – *Furrows*
Number of pollen grains – 1

Genus – *Nigella* Species –
Shape – Oblate spheroidal
Size – 37.6 µ
Pore / colpi – Tricolpate
Number of pollen grains – 15

Plate -1 Figure - 2

Genus – *Clematis* Species – *vitalba*
Shape – Suboblate
Size – 20 µ
Pore / colpi – Tricolpate
Number of pollen grains – 80

Plate - 1

Figure - 4

Genus – *Magnolia*
Species – *grandiflora*
Shape – Oblate
Size – 51.5 µ
Pore / colpi – Monocolporate
Number of pollen grains – 90

Plate - 2

Figure - 6

Genus – *Brassica*
Species – *napus*
Shape – Oblate Spheroidal
Size – 24.4 µ
Pore / colpi – Tricolporate
Number of pollen grains – 63

Plate - 2

Figure - 8

Genus – *Viola*
Species – *tricolor*
Shape – Multisided or Irrigular
Size – 80.4 µ
Pore / colpi – Furrows with bores
Number of pollen grains – 579

Plate - 3

Figure - 10

Genus – *Spergularia*
Species – *rupicola*
Shape – Oval Flattened
Size – 23.7 µ
Pore / colpi – Furrows only
Number of pollen grains – 8

Plate - 3 Figure - 11

Genus – *Stellaria* Species – *media*
Shape – Spheric
Size – 24.4 µ
Pore / colpi – Periporate
Number of pollen grains – 9

Plate - 4 Figure - 13

Genus – *Helianthemum* Species – *chamaecistis*
Shape – Oblate spheroidal
Size – 45.4 µ
Pore / colpi – Tricolporate
Number of pollen grains – 1

Plate - 4 Figure - 14

Genus – *Hibiscus* Species – *rosa - sinensis*
Shape – Spheric
Size - 147.5 µ
Pore / colpi - Tricolporate
Number of pollen grains – 17

Genus – *Abutilon* Species – *indicum*
Shape - Suboblate
Size - 58.3
Pore / colpi - Tricolporate
Number of pollen grains – 8

Genus – *Convolvulus* Species – *arvensis*
Shape - Oblate spheroid
Size - 53.6 µ
Pore / colpi - Tricolporate
Number of pollen grains – 4

Plate - 6 Figure - 17

Genus – *Geranium* Species – *rotundifolium*
Shape – Oblate spheroid
Size - 47.2 µ
Pore / colpi - Tricolporate
Number of pollen grains – 11

Plate - 7 Figure - 20

Genus – *Citrus* Species – *limon*
Shape - Oblate spheroidal
Size - 40.2 µ
Pore / colpi - Tetracolporate
Number of pollen grains – 23

Plate - 7 Figure - 19

Genus – *Impatiens* Species – *glandulifera*
Shape - Long
Size - 47.2 µ
Pore / colpi - Furrows only
Number of pollen grains – 21

Plate - 7 Figure - 22

Genus – *Vitis* Species – *vinifera*
Shape - Oblate spheroidal
Size - 23.1 µ
Pore / colpi - Tricolporate
Number of pollen grains – 16

Plate - 7 Figure - 21

Genus –*Parthenocissus* Species – *tricuspidata*
Shape - Prolate spheroidal
Size - 38.3 µ
Pore / colpi - Tricolporate
Number of pollen grains – 8

Plate - 8 Figure - 23

Genus – *Aesculus* Species – *hippocastanum*
Shape - Prolate spheroidal
Size - 18.5 µ
Pore / colpi - Tricolporate
Number of pollen grains – 2

Plate - 8 Figure - 25

Genus – *Pistacia* Species – *lentiscus*
Shape - Oblate spheroidal
Size - 28.3 µ
Pore / colpi - Stephanoporate
Number of pollen grains – 4

Plate - 8 Figure - 26

Genus – *Platanus* Species – *orientalis*
Shape - Subprolate
Size - 24.2 µ
Pore / colpi - Tricolporate
Number of pollen grains – 3

Genus – *Desmodium* Species –
Shape -
Size -
Pore / colpi -
Number of pollen grains –

Genus – *Erythrina* Species – *indica*
Shape -
Size -
Pore / colpi -
Number of pollen grains –

Plate - 11 Figure - 31

Genus – *Lupinus* Species – *albus*
Shape - Prolate spheroidal
Size - 29.5 µ
Pore / colpi - Tricolporate/tricolporoidate
Number of pollen grains – 5

Plate - 12 Figure - 33

Genus – *Melilotus* Species – *alba*
Shape - Prolate spheroidal
Size - 23.7 µ
Pore / colpi - Tricolporate
Number of pollen grains – 6

Plate - 12 Figure - 35

Genus – *Ononis* Species – *pubescens*
Shape - Prolate
Size - 38.6 µ
Pore / colpi - Tricolporate
Number of pollen grains – 4

Genus – *Ulex* Species – *europacus*
Shape - Oval flattened
Size - 43.5 µ
Pore / colpi - Furrows
Number of pollen grains – 6

Plate - 13 Figure - 38

Genus – *Ulex* Species – *galli*
Shape - Oval flattened
Size - 43.5 µ
Pore / colpi -
Number of pollen grains – 6

Plate - 13 Figure - 40

Genus – *Cassia* Species – *didimobotrye*
Shape - Oblate spheroidal
Size - 34.2 µ
Pore / colpi - Tricolporate
Number of pollen grains – 10

Plate – 14 Figure – 41

Genus – *Acacia* species- *dealbata*
Shape -
Size - 54.1 µ
Pore/colpi - Inaperturarte
Number of pollengrains- 31

Plate - 15 Figure – 43 - 44

Genus – *Malus* Species – *domestica*
Shape - Suboblate
Size - 27.2 µ
Pore / colpi - Tricolporoidate
Number of pollen grains – 7

Plate – 16 Figure –45

Genus – *Prunus* Species – *dulcis*
Shape – Suboblate
Size – 43.4 µ
Pore/Colpi – Tricolporoidate
Number of pollen grains – 98

Plate – 16 Figure – 46

Genus – *Pyrus* Species – *cummunis*
Shape – Triangular
Size – 46.7 µ
Pore/Colpi – Furrows with pores
Number of pollen grains – 80

Plate - 17 Figure - 47

Genus – *Sedum* Species – *acre*
Shape – Suboblate
Size – 24.4 µ
Pore / colpi – Tricolporoidate
Number of pollen grains – 2

Plate - 17 Figure - 48

Genus – *Eucalyptus* Species – *gunii*
Shape - Oblate
Size - 13.5 µ
Pore / colpi - Tricolporate/Syncolpate
Number of pollen grains – 39

Plate - 17 Figure - 49

Genus – *Myrtus* Species – *communis*
Shape – Oblate
Size – 10.7 µ
Pore / colpi – Tricolporate/Syncolpate
Number of pollen grains –

Plate - 17 Figure - 50

Genus – *Passiflora* Species – *edulis*
Shape – Spheric
Size – 64.8 µ
Pore / colpi – Spiraperture syncolpate
Number of pollen grains – 5

Plate - 18 Figure - 52

Genus – *Citrullus* Species – *lanatus*
Shape - Oblate spheroidal
Size - 52.4 µ
Pore / colpi - Tricolporate
Number of pollen grains – 15

Plate - 19 Figure - 53

Genus – *Ecballium* Species – *elaterium*
Shape - Oblate spheroidal
Size - 46.9 µ
Pore / colpi - Tricolporate
Number of pollen grains – 14

Plate - 19 Figure - 55

Genus – *Bupleurum* Species – *fruticosum*
Shape - Prolate
Size - 18.4 µ
Pore / colpi - Tricolporate
Number of pollen grains – 27

Plate - 20 Figure - 57

Genus – *Hedera* Species – *helix*
Shape - Oblate spheroidal
Size - 32.3 µ
Pore / colpi - Tricolporate
Number of pollen grains – 6

Plate - 20 Figure - 58

Genus – *cornus* Species – *sanguinea*
Shape - Prolate spheroidal
Size - 54.3 µ
Pore / colpi - Tricolporate
Number of pollen grains – 45

Plate - 20 Figure - 59

Genus – *Ageratum* Species – *conizoides*
Shape –
Size –
Pore / colpi –
Number of pollen grains – 340

Plate - 20 Figure - 60

Genus – *Arctium* Species –
Shape – Prolate
Size – 45.7 µ
Pore / colpi – Tricolporate
Number of pollen grains – 49

Plate - 21 Figure - 62

Genus – *Carduus* Species –
Shape – Prolate spheroidal
Size – 54.3 µ
Pore / colpi – Tricolporate
Number of pollen grains – 100

Plate - 21 Figure - 63

Genus – *Carthamus* Species –
Shape – Subprolate
Size – 60.6 µ
Pore / colpi – Tricolporate
Number of pollen grains – 7

Plate - 21 Figure - 64

Genus – *Cirsium* Species –
Shape - Oblate spheroidal
Size - 42.1 µ
Pore / colpi - Tricolporate
Number of pollen grains – 24

Genus – *Eupatorium* Species – *japonica*
Shape - Oblate spheroidal
Size - 22.5 µ
Pore / colpi - Tricolporate
Number of pollen grains – 30

Plate - 22

Figure - 65

Genus – *Helianthus*
Species – *Annuus*
Shape – Oblate spheroidal
Size – 38.4 µ
Pore / colpi – Tricolporate
Number of pollen grains – 599

Plate - 22

Figure - 67

Genus – *Matricaria*
Species –
Shape – Oblate spheroidal
Size – 23.6 µ
Pore / colpi – Tricolporate
Number of pollen grains – 17

Plate - 22

Figure - 68

Genus – *Michenia*
Species – *micrantha*
Shape –
Size –
Pore / colpi -
Number of pollen grains – 517

Genus – *Senecio*
Species –
Shape – Oblate spheroidal
Size - 28.2 µ
Pore / colpi - Tricolporate
Number of pollen grains – 13

Plate - 23 Figure - 69

Genus – *Solidago* Species – *canadensis*
Shape – Oblate spheroidal
Size - 22.4 µ
Pore / colpi - Tricolporate
Number of pollen grains – 51

Plate - 23 Figure - 71

Genus – *Xanthium* Species – *strumarium*
Shape – Spherical
Size - 26.8 µ
Pore / colpi - Tricolporate
Number of pollen grains – 57

Plate - 24 Figure - 74

Genus – *Diospyros* Species – *kaki*
Shape – Prolate spheroidal
Size - 45.2 µ
Pore / colpi - Tricolpate
Number of pollen grains – 2

Plate - 24 Figure - 75

Genus – *Fraxinus* Species – *excelsior*
Shape – Oblate spheroidal
Size - 19.5 µ
Pore / colpi - Tricolporoidate
Number of pollen grains – 5

Plate - 25

Figure - 77

Genus – *Cynoglossum*
Species – *creticum*
Shape - Prolate
Size - 18.5 µ
Pore / colpi - Stephanocolporate
Number of pollen grains – 13

Plate -25

Figure - 79

Genus – *Symphylum*
Species – *officinale*
Shape - Prolate
Size - 27.3 µ
Pore / colpi - Stephonocolporate
Number of pollen grains – 4

Plate - 25

Figure - 80

Genus – *Convolvulus*
Species – *arvensis*
Shape - Oblate spheroidal
Size - 53.6 µ
Pore / colpi - Tricolpate
Number of pollen grains – 4

Genus – *Phlox*
Species – *drummondii*
Shape - Irregularly round
Size - 57.6 µ
Pore / colpi - Pores only
Number of pollen grains – 7

Plate - 26 Figure - 81

Genus – *Antirrhinum* Species – *majus*
Shape - Oblate spheroidal
Size - 12.5 µ
Pore / colpi - Tricolporate/Syncolporate
Number of pollen grains – 16

Genus – *Linaria* Species – *vulgaris*
Shape - Irregularly round
Size - 14.2 µ
Pore / colpi - Furrows with pores
Number of pollen grains – 3

Plate - 26 Figure - 82

Genus – *Verbascum* Species – *thapsus*
Shape - Oblate spheroidal
Size - 23.5 µ
Pore / colpi - Tricolpate
Number of pollen grains – 10

Plate - 27 Figure - 83

Genus – *Verbena* Species – *officinalis*
Shape - Oblate spheroidal
Size - 25.4 µ
Pore / colpi - Heterocolpate
Number of pollen grains – 7

Plate - 27

Figure - 84

Genus – *Lavandula*
Shape - Oblate
Size - 25.5
Pore / colpi - Stephanocolpate
Number of pollen grains – 2

Species – *angustifolia*

Plate - 29

Figure – 87 - 88

Genus – *Rosmarinus*
Shape - Suboblate
Size - 33.2 µ
Pore / colpi - Stephanocolpate
Number of pollen grains – 1

Species –

Plate - 29

Figure - 89

Genus – *Teucrium*
Shape - Subprolate
Size - 52.2 µ
Pore / colpi - Tricolpate
Number of pollen grains – 1

Species –

Plate - 29

Figure - 90

Genus – *Thymus*
Shape - Oblate spheroidal
Size - 30.4 µ
Pore / colpi - Stephanocolpate
Number of pollen grains – 12

Species –

Genus – *Plantago* Species – *lanceolata*
Shape - Spheric
Size - 24.3 µ
Pore / colpi - Periporate
Number of pollen grains – 1

Plate - 30 Figure - 92

Genus – *Fagopyrum* Species – *esculentum*
Shape - Subprolate
Size - 40.4
Pore / colpi - Tricolporate
Number of pollen grains – 37

Plate - 31 Figure – 93 - 94

Genus – *Laurus* Species –
Shape - Spheric
Size - 55.4 µ
Pore / colpi - Inaperturate
Number of pollen grains – 3

Plate -32 Figure - 95

Genus – *Daphne* Species – *gnidium*
Shape - Spheric
Size - 21.3 µ
Pore / colpi - Periporate
Number of pollen grains – 2

Genus – *Hippophae* Species – *rhamnoides*
Shape - Irregularly round
Size - 23.4 µ
Pore / colpi - Furrows with pores
Number of pollen grains – 1

Plate -32 Figure - 97

Genus – *Loranthus* Species –
Shape – Oblate
Size - 15.4 µ
Pore / colpi - Tricolporate/Syncolpate
Number of pollen grains – 3

Plate - 32 Figure - 98

Genus – *Chrozophora* Species –
Shape – Suboblate
Size - 54.6 µ
Pore / colpi - Stephanocolporate
Number of pollen grains – 11

Plate - 33 Figure - 99

Genus – *Urtica* Species – *dioica*
Shape – Irregularly round
Size - 13.8 µ
Pore / colpi - pores only
Number of pollen grains – 1

Plate - 33 Figure - 100

Genus – *Ulmus* Species – *procera*
Shape – Suboblate
Size - 25.5 µ
Pore / colpi - Stephanocolporate
Number of pollen grains – 16

Plate - 33 Figure - 101

Genus – *Alnus* Species – *glutinosa*
Shape – Irregular oval
Size - 24.5 µ
Pore / colpi - pores only
Number of pollen grains – 5

Plate - 34 Figure - 104

Genus – *Quercus* Species – *robur*
Shape – Oblate spheroidal
Size - 28.4 µ
Pore / colpi - Tricolporoidate
Number of pollen grains – 43

Plate - 34 Figure - 106

Genus – *Musa* Species – *paradisiaca*
Shape – Circular
Size - 120.6 µ
Pore / colpi - Inaperturate
Number of pollen grains – 2

Plate - 35

Figure - 108

Genus – *Iris*
Species – *unguicularis*
Shape – Round
Size - 78.4 µ
Pore / colpi - Furrows only
Number of pollen grains – 3

Plate - 35

Figure - 109

Genus – *Allium*
Species – *cepa*
Shape – Oblate
Size - 18.5 µ
Pore / colpi - Monocolpate
Number of pollen grains – 32

Genus – *Asparagus*
Species – *acutifolius*
Shape – Oblate
Size - 16.4 µ
Pore / colpi - Monocolpate
Number of pollen grains – 23

Genus – *Smilax*
Species – *aspera*
Shape – Spheric
Size - 20.5 µ
Pore / colpi - Inaperturate
Number of pollen grains – 4

Plate - 36 Figure - 111

Genus – *Alopecurus* Species – *pratensis*
Shape – Round
Size - 47.5 µ
Pore / colpi - Pores only
Number of pollen grains – 2

Plate - 38 Figure – 114 - 116

Genus – *Pinus* Species – *insularis*
Shape – Multisided or irregular
Size - 86.3 µ
Pore / colpi -
Number of pollen grains – 3

Plate - 39 Figure - 117

Genus – *Cupressus* Species – *sempervirens*
Shape – Spheroid
Size - 24.1 µ
Pore / colpi - Monoporate
Number of pollen grains – 5

Ungma Village

Winter samples of honey obtained from Ungma Village of Mokokchung district reveal the presence of following types of pollen grains belonging to various members of respective families in the honey

collected by the bees of *Apis indica* . The number of pollen grains is given per ml of honey sample.

Ranunculaceae - *Helleborus niger, Nigella sp, Clematis vitalba*, Magnoliaceae - *Liriondendron tulipifera, Magnolia grandiflora*, Berberidaceae - *Berberis darwinii*, Papaveraceae - *Hypecoum procumben*, Brassicaceae - *Brassica napus, B. oleifera Cardamine pratensis*, Violaceae - *Viola tricolor*, Caryophyllaceae - *Lychnis floscuculi*, Tamaricaceae - *Tamarix gallica*, Malvaceae - *Hibiscus rosa - sinesis, Malva sylvestris*, Tiliaceae - *Tilia peteolaris*, Geraniaceae - *Geranium pretense, G. rotundifolium*, Oxalidaceae - *Oxalis articulata*, Rutaceae - *Citrus limon*,Vitaceae - *Parthenocissus tricuspidata, Vitis vinifera*, Aceraceae - *Acer pseudoplatanus*, Anacardiaceae - *Pistacia lentiscus*, Platanaceae - *Platanus orientalis*, Fabaceae - *Calycotome spinosa, Ceratonia siliqua, Coronilla emerus, Colutea arborescens, Desmodium sp, Erythrina indica, Gleditsia triacanthos, Lupinus albus, Medicago sativa, Ononis pubescens*, O. *spinosa, Onobrychis vicifolia, Sophora japonica, Trifolium alexandrium, Vicia faba*, Caesalpiniaceae - *Cassia didimobotrya*, Mimosoideae - *Acacia dealbata*, Rosaceae - *Crataegus monogyna, Filipendula ulmaria, Malus domestica, Prunus dulcis, Pyrus Communis*, Crassulaceae - *Sedum acre*, Myrtaceae *Eucalyptus gunnii, Myrtus communis*, Passifloraceae - *Passiflora edulis*, Cucurbitaceae - *Bryonia dioica, Citrullus lanatus, Cucurbita pepo*, Apiaceae *Bupleurum fruticosum*, Araliaceae - *Hedera helix*, Cornaceae - *Cornus sanguinea*, Asteraceae - *Ageratum conizoides, Aster sp, Carduus sp, Carthamus sp, Eupatorium japonica, Helianthus annuus, Inula sp, Solidago canadensis, Taraxacum officinale, Xanthium strumarium*, Ericaceae - *Arbutus unedo, Erica sp*, Plumbaginaceae - *Armeria maritima*, Ebenaceae - *Diospyrus kaki*, Oleaceae - *Fraxinus excelsior*, Buddlejaceae *Buddleja officinalis, Symphytum officinate*, Convolvulaceae *Convolvulus arvensis*, Polemoniaceae - *Phlox drummondii*, Scrophulariaceae - *Linaria vulgaris, Verbascum thapsus*, Verbenaceae - *Verbena officinalis*, Lamiaceae - *Lavandula stoechas, Mentha pulegium, Teucrium sp, Thymus sp*, Plantaginaceae - *Plantago lanceolata*, Chenopodiaceae - *Chenopodium*, Polygonaceae - *Fagopyrum esculentum*, Lauraceae - *Laurus nobilis*,

Loranthaceae - *Loranthus*, Euphorbiaceae - *Chrozophora*, Urticaceae - *Urtica dioica*, Ulmaceae - *Ulmus procera*, Betulaceae - *Alnus glutinoso*, *Betula pendula*, *Castanea sativa*, Fagaceae - *Quercus robur*, Salicaceae - *Populus tricocarpa*, *Salix caprea*, Liliaceae - *Asparagus acutifolius*, *Asphodelus microcarpus*, *Allium cepa*, Poaceae - *Zea mays*, Pinaceae - *Pinus insularis*.

Plate - 1 Figure -1

Genus – *Helleborus* Species – *niger*
Shape – Irregularly round
Size - 35 µ
Pore / colpi - Furrows
Number of pollen grains – 7

Genus – *Nigella* Species –
Shape – Oblate spheroidal
Size - 37.6 µ
Pore / colpi - Tricolpate
Number of pollen grains – 10

Plate - 1 Figure - 2

Genus – *Clematis* Species – *vitalba*
Shape –
Size –
Pore / colpi –
Number of pollen grains – 11

Plate -1 Figure - 3

Genus – *Liriodendron* Species – *tulipifera*
Shape – Suboblate
Size – 51.6 µ
Pore / colpi – Monocolpate
Number of pollen grains – 2

Plate - 1 Figure - 4

Genus – *Magnolia* Species – *grandiflora*
Shape – Oblate
Size – 51.5 µ
Pore / colpi – Monocolpate
Number of pollen grains – 26

Plate - Figure –

Genus – *Berberis* Species – *darwinii*
Shape – Irregularly round
Size – 40.1 µ
Pore / colpi – United or irregular furriws may occur
Number of pollen grains – 70

Plate - 2 Figure - 5

Genus – *Hypecoum* Species – *procumben*
Shape – Prolate spheroidal
Size – 24.5 µ
Pore / colpi - Dicolbate
Number of pollen grains – 8

Plate - 2 Figure - 6

Genus – *Brassica* Species – *napus*
Shape – Oblate spheroidal
Size – 24.7 µ
Pore / colpi – Tricolpate
Number of pollen grains – 58

Genus – *Brassica* Species – *oleifera*
Shape – Oblate spheroidal
Size – 24.7 µ
Pore / colpi – Tricolpate
Number of pollen grains – 68

Plate - 2 Figure - 7

Genus – *Cardamine* Species – *pratensis*
Shape – Irregularly round
Size – 24.6
Pore / colpi – Furrows only
Number of pollen grains – 50

Plate - 2 Figure - 8

Genus – *Viola* Species – *tricolor*
Shape – Multisided or irregular
Size – 80.4 µ
Pore / colpi – Furrows with pores
Number of pollen grains – 106

Plate - 3 Figure – 9

Genus – *Lychnis* Species – *flos -cuculis*
Shape – Spheric
Size - 45.5 µ
Pore / colpi - Periporate
Number of pollen grains – 4

Plate - 3 Figure - 12

Genus – *Tamarix* Species – *gallica*
Shape – Oblate spheroidal
Size - 18.8 µ
Pore / colpi - Tricolpate
Number of pollen grains – 5

Plate - 4 Figure - 14

Genus – *Hibiscus* Species – *rosa-sinesis*
Shape – Spheric
Size – 147.5 µ
Pore / colpi – Periporate
Number of pollen grains – 2

Genus – *Malva* Species – *sylvestris*
Shape – Spheric
Size – 105.4 µ
Pore / colpi – Periporate
Number of pollen grains – 2

Plate - 5 Figure - 15

Genus – *Tilia* Species – *petiolaris*
Shape – Triagular/irregular
Size – 35.6 µ
Pore / colpi – Furrows with pores
Number of pollen grains – 23

Plate - 5 Figure - 16

Genus – *Geranium* Species – *pratense*
Shape – Oblate spheroidal
Size – 47.2
Pore / colpi – Tricolporate
Number of pollen grains – 10

Plate - 6 Figure - 17

Genus – *Geranium* Species – *rotundifolium*
Shape – Oblate spheroidal
Size – 45.3 µ
Pore / colpi – Tricolporate
Number of pollen grains – 11

Plate - 6 Figure - 18

Genus – *Oxalis* Species – *articulata*
Shape – Oblate spheroidal
Size – 32.5 µ
Pore / colpi – Tricolporate
Number of pollen grains – 1

Plate - 7 Figure - 20

Genus – *Citrus* Species – *limon*
Shape – Oblate spheroidal
Size – 40.2 µ
Pore / colpi – Tetracolporate
Number of pollen grains – 5

Plate - 7 Figure - 21

Genus – *Parthenocissus* Species – *tricuspidata*
Shape – Prolate spheroidal
Size – 38.3 µ
Pore / colpi – Tricolporate
Number of pollen grains – 95

Plate - 7 Figure - 22

Genus – *Vitis* Species – *vinifera*
Shape – Oblate spheroidal
Size – 38.3
Pore / colpi – Tricolporate
Number of pollen grains – 84

Plate - 8 Figure - 24

Genus – *Acer* Species – *pseudoplatanus*
Shape – Oval flattened
Size - 43.8 µ
Pore / colpi - Furrows only
Number of pollen grains – 1

Plate - 8 Figure - 25

Genus – *Pistacia* Species – *lentiscus*
Shape - Oblate spheroidal
Size - 28.3 µ
Pore / colpi - Stephanoporate
Number of pollen grains – 3

Plate - 8 Figure - 26

Genus – *Platanus* Species – *orientalis*
Shape – Subprolate
Size - 24.2 µ
Pore / colpi - Tricolpate
Number of pollen grains – 25

Plate - 10 Figure - 28

Genus – *Calycotome* Species – *spinosa*
Shape - oblate spheroidal
Size - 25.2 µ
Pore / colpi - Tricolpate
Number of pollen grains – 22

Genus – *Ceratonia* Species – *siliqua*
Shape - Oblate spheroidal
Size - 23.5
Pore / colpi - Tetracolporate
Number of pollen grains – 20

Plate - 9

Figure -27

Genus – *Coronilla*
Species – *emerus*
Shape - Oblate spheroidal
Size - 27.2 µ
Pore / colpi - Tricolporoidate
Number of pollen grains – 26

Genus – *Colutea*
Species – *arborescens*
Shape - Oblate spheroidal
Size - 35.2 µ
Pore / colpi - Tricolporate
Number of pollen grains – 70

Genus – *Desmodium*
Species –
Shape -
Size -
Pore / colpi -
Number of pollen grains –

Genus – *Erythrina*
Species – *indica*
Shape -
Size -
Pore / colpi -
Number of pollen grains –

Plate -11 Figure - 29

Genus – *Gleditsia* Species – *triacanthos*
Shape - Oblate spheroidal
Size - 32.4 µ
Pore / colpi - Tricolporate
Number of pollen grains – 27

Plate - 11 Figure - 31

Genus – *Lupinus* Species – *albus*
Shape - Prolate spheroidal
Size - 29.5 µ
Pore/colpi -
Number of pollen grains – 32

Plate - 11 Figure - 32

Genus – *Medicago* Species – *sativa*
Shape – Oblate spheroidal
Size - 32.9 µ
Pore / colpi - Tricolporoidate
Number of pollen grains – 9

Plate - 12 Figure - 35

Genus – *Ononis* Species – *pubescens*
Shape - Prolate
Size - 38.6 µ
Pore / colpi - Tricolporate
Number of pollen grains – 47

Genus – *Ononis* Species – *spinosa*
Shape - Prolate
Size - 22.3 µ
Pore / colpi - Tricolporate
Number of pollen grains – 42

Plate - 12 Figure - 34

Genus – *Onobrychis* Species – *vicifolia*
Shape - Prolate
Size - 27.9 µ
Pore / colpi - Tricolpate
Number of pollen grains – 29

Plate - 13 Figure - 37

Genus – *Sophora* Species – *japonica*
Shape - Prolate spheroidal
Size - 17.2 µ
Pore / colpi - Tricolporate
Number of pollen grains – 143

Genus – *Trifolium* Species – *alexandrinum*
Shape - Prolate spheroidal
Size - 42.4 µ
Pore / colpi - Tricolporate
Number of pollen grains – 54

Plate - 13 Figure - 39

Genus – *Vicia* Species – *faba*
Shape - Prolate
Size - 51.4 µ
Pore / colpi - Tricolporate
Number of pollen grains – 2

Plate - 13 Figure - 40

Genus – *Cassia* Species – *didimobotrya*
Shape - Oblate spheroidal
Size - 34.2 µ
Pore / colpi - Tricolporate
Number of pollen grains – 39

Plate - 14 Figure - 41

Genus – *Acacia* Species – *dealbata*
Shape -
Size - 54.1 µ
Pore / colpi - Inaperture
Number of pollen grains –

Plate - 14 Figure - 42

Genus – *Crataegus* Species – *monogyna*
Shape - Oblate spheroidal
Size - 37.5 µ
Pore / colpi - Tricolporoidate
Number of pollen grains – 60

Plate - 15 Figure – 43 - 44

Genus – *Malus* Species – *domestica*
Shape - Suboblate
Size - 27.2 µ
Pore / colpi - Tricolporate
Number of pollen grains – 90

Plate - 16 Figure - 45

Genus – *Prunus* Species – *dulcis*
Shape - Subolblate
Size - 43.4 µ
Pore / colpi - Tricolporoidate
Number of pollen grains – 81

Plate – 16 Figure – 46

Genus – *Pyrus* Species – *cummunis*
Shape - Triangular
Size - 46.7 µ
Pore/Colpi - Furrows with pores
Number of pollen grains – 118

Plate - 17 Figure - 47

Genus – *Sedum* Species – *acre*
Shape - Oblate spheroidal
Size - 24.5 µ
Pore / colpi - Tricolporate
Number of pollen grains – 52

Plate - 17 Figure - 48

Genus – *Eucalyptus* Species – *gunii*
Shape - Oblate
Size - 13.5 µ
Pore / colpi - Tricolporate/syncolpate
Number of pollen grains – 198

Plate - 17 Figure - 49

Genus – *Mrytus* Species – *communis*
Shape - Oblate
Size - 10.7 µ
Pore / colpi - Tricolporate/syncolpate
Number of pollen grains – 141

Plate - 17 Figure - 50

Genus – *Passiflora* Species – *edulis*
Shape - Spheric
Size - 64.8 µ
Pore / colpi - Spiraperture Syncolpate
Number of pollen grains – 10

Plate - 18 Figure -51

Genus – *Bryonia* Species – *dioica*
Shape - Irregularly round
Size - 38.4 µ
Pore / colpi - Furrows with pores
Number of pollen grains – 12

Plate - 18 Figure - 52

Genus – *Citrullus* Species – *lanatus*
Shape - Oblate spheroidal
Size - 52.4 µ
Pore / colpi - Tricolporate
Number of pollen grains – 12

Plate - 19 Figure - 54

Genus – *Cucurbita* Species – *pepo*
Shape - Spheric
Size - 115.7 µ
Pore / colpi - Periporate
Number of pollen grains – 1

Plate - 19 Figure - 55

Genus – *Bupleurum* Species – *fruticosum*
Shape - Prolate
Size - 18.4 µ
Pore / colpi - Tricolporate
Number of pollen grains – 22

Plate - 20 Figure - 57

Genus – *Hedera* Species – *helix*
Shape - Oblate spheroidal
Size - 32.3 µ
Pore / colpi - Tricolporate
Number of pollen grains – 23

Plate - 20 Figure - 58

Genus – *Cornus* Species – *sanguinea*
Shape - Prolate spheroidal
Size - 54.3 µ
Pore / colpi - Tricolporate
Number of pollen grains – 57

Plate - 20 Figure - 59

Genus – *Ageratum* Species – *conizoides*
Shape -
Size -
Pore / colpi -
Number of pollen grains – 609

Plate - 21 Figure - 61

Genus – *Aster* Species –
Shape - Triangular
Size - 23.5 µ
Pore / colpi - Furrows with pores
Number of pollen grains – 203

Plate - 21 Figure - 62

Genus – *Carduus* Species –
Shape - Oblate spheroidal
Size - 42.4 µ
Pore / colpi - Tricolporate
Number of pollen grains – 41

Plate - 21 Figure -63

Genus – *Carthamus* Species –
Shape - Subprolate
Size - 60.6 µ
Pore / colpi - Tricolporate
Number of pollen grains – 148

Genus – *Eupatorium* Species – *japonica*
Shape - Oblate spheroidal
Size - 22.5 µ
Pore / colpi - Tricolporate
Number of pollen grains – 242

Plate - 22 Figure - 65

Genus – *Helianthus* Species – *annuus*
Shape - Oblate spheroidal
Size - 38.4 µ
Pore / colpi - Tricolporate
Number of pollen grains – 1041

Plate - 22 Figure - 66

Genus – *Inula* Species –
Shape - Oblate spheroidal
Size - 31.2 µ
Pore / colpi - Tricolporate
Number of pollen grains – 37

Plate - 23 Figure - 69

Genus – *Solidago* Species – *canadensis*
Shape - Oblate spheroidal
Size - 22.4 µ
Pore / colpi - Tricolporate
Number of pollen grains – 88

Plate - 23 Figure - 70

Genus – *Taraxacum* Species – *officinale*
Shape - Oblate spheroidal
Size - 34.3
Pore / colpi - Tricolporate/Tetracolporate
Number of pollen grains – 98

Plate - 23 Figure - 71

Genus – *Xanthium* Species – *strumarium*
Shape - Spherical
Size - 26.8 µ
Pore / colpi - Tricolporate
Number of pollen grains – 249

Plate - 23 Figure -72

Genus – *Arbutus* Species – *unedo*
Shape -
Size - 52.5 µ
Pore / colpi - Tricolporate
Number of pollen grains – 1

Plate - 24 Figure - 73

Genus – *Erica* Species –
Shape -
Size - 32.4 µ
Pore / colpi - Tricolporate
Number of pollen grains – 41

Genus – *Armeria* Species – *maritima*
Shape -
Size - 76.8 µ
Pore / colpi - Furrows only
Number of pollen grains –

Plate - 24 Figure - 74

Genus – *Diospyrus* Species - *kaki*
Shape - Prolate spheroidal
Size - 45.2 µ
Pore / colpi - Tricolpate
Number of pollen grains – 5

Plate - 24 Figure - 75

Genus – *Fraxinus* Species- *excelsior*
Shape - Oblate spheroidal
Size - 19.5 µ
Pore / colpi - Tricolporoidate
Number of pollen grains – 2

Genus – *Buddleja* Species- *davidii*
Shape -
Size - 18.5 µ
Pore / colpi - Furrows with pores
Number of pollen grains – 13

Plate - 24 Figure - 76

Genus – *Alkanna* Species – *tinctoria*
Shape - Prolate
Size - 12.5 µ
Pore / colpi - Tricolporate
Number of pollen grains – 16

Genus – *Borago* Species – *officinalis*
Shape - Oblate spheroidal
Size - 38.5 µ
Pore / colpi - Stephanocolporate
Number of pollen grains – 14

Plate - 25 Figure - 79

Genus – *Symphytum* Species – *officinale*
Shape - Prolate
Size - 27.3 µ
Pore / colpi - Stephanocolporate
Number of pollen grains – 34

Plate - 25 Figure - 80

Genus – *Convolvulus* Species – *arvensis*
Shape - Oblate spheroidal
Size - 53.6 µ
Pore / colpi - Tricolpate
Number of pollen grains -18

Genus – *Phlox* Species – *drummondi*
Shape - Irregularly round
Size - 57.6 µ
Pore / colpi - Pores only
Number of pollen grains – 14

Genus – *Linaria* Species –*vulgaris*
Shape - Irregularly round
Size - 14.2 µ
Pore / colpi - Furrows with pores
Number of pollen grains – 4

Plate - 26 Figure - 82

Genus –*Verbascum* Species – *thapsas*
Shape - Oblate spheroidal
Size - 23.5 µ
Pore / colpi - Tricolporate
Number of pollen grains – 1

Plate - 27 Figure - 83

Genus – *Verbena* Species – *officinalis*
Shape - Oblate spheroidal
Size - 25.4 µ
Pore / colpi - Heterocolpate
Number of pollen grains – 4

Genus – *Lavandula* Species – *stoechas*
Shape - Oblate
Size - 25.5 µ
Pore / colpi - Stephanocolpate
Number of pollen grains – 2

Plate - 28 Figure – 85 - 86

Genus – *Mentha* Species – *pulegium*
Shape - Oblate spheroidal
Size - 18.5 µ
Pore / colpi - Stephanocolpate
Number of pollen grains – 22

Plate - 29 Figure - 89

Genus – *Teucrium* Species –
Shape - Subprolate
Size - 52.2 µ
Pore / colpi - Tricolpate
Number of pollen grains – 1

Plate - 29 Figure - 90

Genus – *Thymus* Species –
Shape - Oblate spheroidal
Size - 30.4 µ
Pore / colpi - Stephanocolpate
Number of pollen grains – 22

Genus – *Plantago* Species – *lanceolata*
Shape - Spheric
Size - 24.3 µ
Pore / colpi - Periporate
Number of pollen grains – 6

Plate - 30 Figure - 91

Genus – *Chenopodium* Species –
Shape - Spheric
Size - 26.5 µ
Pore / colpi - Periporate
Number of pollen grains – 16

Plate - 30 Figure - 92

Genus – *Fagopyrum* Species – *esculentum*
Shape - Subprolate
Size - 40.4
Pore / colpi - Tricolporate
Number of pollen grains – 6

Plate - 31 Figure – 93 - 94

Genus – *Laurus* Species – *nobilis*
Shape - Spheric
Size - 55.4 µ
Pore / colpi - Inaperturate
Number of pollen grains – 81

Plate - 32 Figure - 97

Genus – *Loranthus* Species –
Shape - Oblate
Size - 15.4 µ
Pore / colpi - Tricolporate/Syncolpate
Number of pollen grains – 2

Plate - 32 Figure – 98

Genus – *Chrozophora* Species –
Shape - Suboblate
Size - 54.6 µ
Pore / colpi - Stephanocolporae
Number of pollen grains – 10

Plate - 33 Figure – 99

Genus – *Urtica* Species – *dioica*
Shape - Irregularly round
Size - 13.8 µ
Pore / colpi - Pores only
Number of pollen grains – 6

Plate - 33 Figure - 100

Genus – *Ulmus* Species – *procera*
Shape - Suboblate
Size - 25.5 µ
Pore / colpi - Stephanocolporate
Number of pollen grains – 4

Plate - 33 Figure – 101

Genus – *Alnus* Species – *glutinosa*
Shape - Irregular oval
Size - 24.5 µ
Pore / colpi - Pores only
Number of pollen grains – 1

Plate - 33 Figure - 102

Genus – *Betula* Species – *pendula*
Shape -
Size - 26.2 µ
Pore / colpi - Pores only
Number of pollen grains – 7

Plate - 34 Figure - 103

Genus – *Castanea* Species – *sativa*
Shape - Prolate
Size - 15.7 µ
Pore / colpi - Tricolporate
Number of pollen grains – 21

Plate - 34 Figure - 104

Genus – *Quercus* Species – *robur*
Shape - Oblate Spheroidal
Size - 28.4 µ
Pore / colpi - Tricolporate
Number of pollen grains – 11

Plate - 34 Figure - 105

Genus – *Populus* Species – *tricocarpa*
Shape - Spheric
Size - 26.2 µ
Pore / colpi - Periporate
Number of pollen grains –

Genus – *Salix* Species – *caprea*
Shape – Subprolate
Size – 18.4 µ
Pore / colpi - Tricolporate
Number of pollen grains –

Genus – *Asparagus* Species – *acutifolis*
Shape - Oblate
Size - 16.4 µ
Pore / colpi - Monocolpate
Number of pollen grains – 35

Plate - 35 Figure - 109

Genus – *Allium* Species – *cepa*
Shape - Oblate
Size - 18.5 µ
Pore / colpi - Monocolpate
Number of pollen grains – 44

Plate - 35 Figure - 110

Genus – *Asphodelus* Species – *microcarpus*
Shape - Suboblate
Size - 40.2 µ
Pore / colpi - Monocolpate
Number of pollen grains – 3

Plate - 36 – 37 Figure – 112 - 113

Genus – *Zea* Species – *mays*
Shape - Round
Size - 70.4 µ
Pore / colpi - Monoulcerate
Number of pollen grains – 231

Plate - 38 Figure – 114 - 116

Genus – *Pinus* Species – *insularis*
Shape - Multisided or irregular
Size - 86.3 µ
Pore / colpi -
Number of pollen grains – 2

Khensa Village

Winter samples of honey obtained from Khensa Village of Mokokchung district reveal the presence of following types of pollen grains belonging to various members of respective families in the honey collected by the bees of *Apis indica*. The number of pollen grains is given per ml of honey sample.

Ranunculaceae - *Helleborus niger*, Magnoliaceae - *Magnolia grandifolia*, Berberidaceae - *Berberis darwinii*, Brassicaceae - *Brassica napus*, *Cardamine pratensis*,Violaceae - *Viola tricolor*, Caryophyllaceae - *Lychnis flos cuculi*, Malvaceae - *Hibiscus rosa – sinensis*, *Abutilon indicum*, *rosa sinensis*, Tiliaceae - *Tilia petiolaris*, Geraniaceae - *Geranium pratense*,*G. rotundifolium*, Oxalidaceae - *Oxalis articulata*, Balsaminaceae - *Impatiens glandulifera*, Rutaceae - *Citrus limon*, Vitaceae - *Parthenocissus tricuspidata*, Anacardiaceae - *Pistacea lentiscus*, Plantanaceae - *Platanus orientalis*, Fabaceae - *Colutea arborescens Gleditsa triancanthos*, *Onobrychis vicifolia*, *Ononis pubescens*, *Sophora japonica*, *Ulex gali*, Caesalpiniaceae - *Cassia didimobotrya*, Mimosoideae - *Acacia dealbata*, Rosaceae - *Crataegus monogyna*, *Eriobotrya japonica*, *Malus domestica*, *Prunus dulcis*, Myrtaceae - *Myrtus communis*, Passifloraceae - *Passiflora edulis*, Cucurbitaceae - *Bryonia dioica*, *Citrullus lanatus*, Apiaceae - *Bupleureum fruticosm*, *Smyrnium olusatrum*, Araliaceae – *Hedera helix*, Cornaceae - *Cornus sanguinea*, *Asteraceae* - *Ageratum conizoides*, *Aster sp*, *Carduus sp*, *Carthamus sp*, *Cirsium*, *Eupatorium japonica*, *Helianthus annuus*, *Inula sp*, *Matricaria sp*, *Michenia micratha*, *Senecio sp*, *Solidago canadensis*, *Taraxacum sp*, *Xanthium strumarium*, Ericaceae – *Erica sp*, Oleaceae - *Fraxinus excelsior*, Boraginaceae - *Echium italicum*, *Symphytum officinale*, Convolvulaceae - *Convolvulus cantabrica*, Polemoniaceae - *Phlox drummondi*, Scrophulariaceae - *Antirrhinum majus*, *Linaria vulgaris*, Verbanaceae - *Verbena officinalis*, Laminceae - *Lavandula agustifolia*, L. *stoechas*, *Mentha pulegium*, *Rosmarinus*, Plantaginaceae - *Plantago lanceolata*,

Chenopodiaceae – *Chenopodium sp*, Polygonaceae - *Fagopyrum esculentum*, Lauraceae - *Laurus nobilis*, Elaeagnaceae - *Hippophae rhamnoides*, Loranthaceae - *Loranthus sp*, Euphorbiaceae – *Chrozophora sp*, Urticaceae - *Urtica dioica*, Ulmaceae - *Ulmus procera*, Fagaceae - *Quercus robur*, Salicaceae - *Populus tricocarpa*, Musaceae - *Musa paradisiaca*, Iridaceae - *Iris unguicularis*, Liliaceae - *Asparagus acutifolis*, Smilacaceae - *Smilax aspera*, Poaceae - *Zea mays*, *Alopecurus pratensis*, Cupressaceae - *Cupressus sempevirens*.

Plate - 1 Figure - 1

Genus – *Helleborus* Species – *niger*
Shape - Irregularly round
Size - 35 µ
Pore / colpi - Furrows
Number of pollen grains – 15

Plate - 1 Figure - 4

Genus – *Magnolia* Species – *grandifolia*
Shape - Oblate
Size - 51.5 µ
Pore / colpi - Monocolporate
Number of pollen grains – 28

Plate - Figure -

Genus – *Berberis* Species – *darwinii*
Shape - Irregularly round
Size - 40.1 µ
Pore / colpi - United or irregular furrows may occur
Number of pollen grains – 43

Plate - 2 Figure - 6

Genus – ***Brassica*** Species – *napus*
Shape – Oblate spheroid
Size - 24.7 µ
Pore / colpi - Tricolporate
Number of pollen grains – 22

Plate - 2 Figure - 7

Genus – *Cardamine* Species – *pratensis*
Shape – Iregularly round
Size - 24.6 µ
Pore / colpi - Furrows only
Number of pollen grains – 29

Plate - 2 Figure - 8

Genus – *Viola* Species – *tricolor*
Shape – Multisided or irregular
Size - 80.4 µ
Pore / colpi - Furrows with pores
Number of pollen grains – 80

Plate - 3 Figure - 9

Genus – *Lychnis* Species – *flos-cuculi*
Shape – Spheric
Size - 45.5 µ
Pore / colpi - Periporate
Number of pollen grains – 7

Genus – *Abutilon* Species – *indicum*
Shape – Suboblate
Size - 58.3 µ
Pore / colpi - Tricolporate
Number of pollen grains – 1

Plate - 4 Figure - 14

Genus – *Hibiscus* Species – *rosa-sinesis*
Shape – Spheric
Size - 147.5 µ
Pore / colpi - Periporate
Number of pollen grains – 32

Plate - 5 Figure - 15

Genus – *Tilia* Species – *petiolaris*
Shape – Triangular/irregular
Size - 35.6 µ
Pore / colpi - Furrows with pores
Number of pollen grains – 13

Plate - 5 Figure - 16

Genus – *Geranium* Species – *pratense*
Shape – Oblate spheroidal
Size - 47.2 µ
Pore / colpi - Tricolporate
Number of pollen grains – 13

Plate - 6 Figure - 17

Genus – *Geranium* Species – *rotundifolium*
Shape – Oblate spheroidal
Size - 45.3 µ
Pore / colpi - Tricolporate
Number of pollen grains –20

Plate - 6 Figure - 18

Genus – *Oxalis* Species – *articulata*
Shape – Oblate spheroidal
Size - 32.5 µ
Pore / colpi - Tricolporate
Number of pollen grains – 13

Plate - 7 Figure - 19

Genus – *Impatiens* Species – *glandulifera*
Shape – Long
Size - 42.7 µ
Pore / colpi - Furrows only
Number of pollen grains –13

Plate - 7 Figure - 20

Genus – *Citrus* Species – *limon*
Shape – Oblate spheroidal
Size - 40.2 µ
Pore / colpi - Tetracolporate
Number of pollen grains – 21

Plate - 7 Figure – 21

Genus – *Parthenocissus* Species – *tricuspidata*
Shape – Prolate spheroidal
Size - 38.3 µ
Pore / colpi - Tricolporate
Number of pollen grains – 39

Plate - 8 Figure - 25

Genus – *Pistacia* Species – *lentiscus*
Shape – Oblate spheroidal
Size - 28.3 µ
Pore / colpi - Stephanoporate
Number of pollen grains – 1

Plate - 8 Figure - 26

Genus – *Platanus* Species – *orientalis*
Shape – Subprolate
Size - 24.3 µ
Pore / colpi - Tricolporate
Number of pollen grains – 21

Genus – *Colutea* Species – *arborescens*
Shape – Oblate spheroidal
Size - 35.2 µ
Pore / colpi - Tricolporate
Number of pollen grains – 45

Plate - 11 Figure - 29

Genus – *Gleditsa* Species – *triancanthos*
Shape – Oblate spheroidal
Size - 32.4 µ
Pore / colpi - Tricolporate
Number of pollen grains – 35

Genus – *Onobrychis* Species – *vicifolia*
Shape – Prolate
Size - 27.9 µ
Pore / colpi - Tricolporate
Number of pollen grains – 10

Plate - 12 Figure - 35

Genus – *Ononis* Species – *pubescens*
Shape – Prolate
Size - 38.6 µ
Pore / colpi - Tricolporate
Number of pollen grains – 37

Plate - 13 Figure - 37

Genus – *Sophora* Species – *japonica*
Shape – Prolate spheroidal
Size - 17.2 µ
Pore / colpi - Tricolporate
Number of pollen grains – 37

Plate - 13 Figure - 38

Genus – *Ulex* Species – *galli*
Shape – Oval flattened
Size - 43.5 µ
Pore / colpi - Furrows only
Number of pollen grains – 7

Plate - 13 Figure - 40

Genus – *Cassia* Species – *didimobtrya*
Shape – Oblate spheroidal
Size - 34.2 µ
Pore / colpi - Tricolporate
Number of pollen grains – 37

Plate – 14 Figure – 41

Genus – *Acacia* Species – *dealbata*
Shape –
Size – 54.1 µ
Pore/Colpi – Inaperturate
Number of pollen grains – 46

Plate - 14 Figure - 42

Genus – *Crataegus* Species – *monogyna*
Shape – Oblate spheroidal
Size - 37.5 µ
Pore / colpi - Tricolporoidate
Number of pollen grains – 37

Genus – *Eriobotrya* Species – *japonica*
Shape – Suboblate
Size - 24.4 µ
Pore / colpi - Tricolporoidate
Number of pollen grains – 43

Plate - 15 Figure - 43-44

Genus – *Malus* Species – *domestica*
Shape – Suboblate
Size - 27.2 µ
Pore / colpi - Tricolporate
Number of pollen grains – 52

Plate - 16 Figure - 45

Genus – *Prunus* Species – *dulcis*
Shape – Suboblate
Size - 43.4 µ
Pore / colpi - Tricolporoidate
Number of pollen grains – 64

Plate – 16 Figure – 46

Genus – *Pyrus* Species – *cummunis*
Shape - Triangular
Size - 46.7 µ
Pore/Colpi – Furrows with pores
Number of pollen grains – 65

Plate - 17 Figure - 49

Genus – *Myrtus* Species – *communis*
Shape – Oblate
Size - 10.7 µ
Pore / colpi - Tricolporate/Syncolpate
Number of pollen grains – 100

Plate - 17 Figure – 50

Genus – *Passiflora* Species – *edulis*
Shape – Spheric
Size - 64.8 µ
Pore / colpi - Spiraperture Syncolpate
Number of pollen grains – 3

Plate - 18 Figure - 51

Genus – *Bryonia* Species – *dioica*
Shape – Irregularly round
Size - 38.4 µ
Pore / colpi - Furrows with pores
Number of pollen grains – 15

Plate - 18 Figure - 52

Genus – *Citrullus* Species – *kanatus*
Shape – Oblate spheroidal
Size - 115.7 µ
Pore / colpi - Periporate
Number of pollen grains – 20

Plate - 19 Figure - 55

Genus – *Bupleureum* Species – *fruticosum*
Shape – Prolate
Size - 18.4 µ
Pore / colpi - Tricolporate
Number of pollen grains – 31

Plate - 19 Figure - 56

Genus –*Symrnium* Species – *olustrum*
Shape – Prolate
Size - 30.4 µ
Pore / colpi - Tricolporate
Number of pollen grains –2

Plate - 20 Figure – 57

Genus – *Hedera* Species – *helix*
Shape – Oblate spheroidal
Size - 32.3 µ
Pore / colpi - Tricolporate
Number of pollen grains – 2

Plate - 20 Figure - 58

Genus – *Cornus* Species – *sanguina*
Shape – Prolate spheroidal
Size - 54.3 µ
Pore / colpi - Tricolporate
Number of pollen grains – 83

Plate - 20 Figure - 59

Genus – *Ageratum* Species – *conizoides*
Shape –
Size -
Pore / colpi -
Number of pollen grains – 508

Plate - 21 Figure - 61

Genus – *Aster* Species –
Shape – Triagular
Size - 23.5 µ
Pore / colpi - Furrows with pores
Number of pollen grains – 333

Plate - 21 Figure - 62

Genus – *Carduus* Species –
Shape – Oblate spheroidal
Size - 42.4 µ
Pore / colpi - Tricolporate
Number of pollen grains – 150

Plate - 21 Figure - 63

Genus – *Carthamus* Species –
Shape – Subprolate
Size - 60.6 µ
Pore / colpi - Tricolporate
Number of pollen grains – 17

Plate - 21 Figure - 64

Genus – *Cirsium* Species –
Shape – Oblate spheroidal
Size - 42.1 µ
Pore / colpi - Tricolporate
Number of pollen grains – 12

Genus – *Eupatorium* Species – *japonica*
Shape – Oblate spheroidal
Size - 22.5 µ
Pore / colpi - Tricolporate
Number of pollen grains – 103

Plate - 22 Figure – 65

Genus – *Halianthus* Species – *annuus*
Shape – Oblate spheroidal
Size - 38.4 µ
Pore / colpi - Tricolporate
Number of pollen grains – 275

Plate - 22 Figure - 66

Genus – *Inula* Species –
Shape – Oblate spheroidal
Size - 31.2 µ
Pore / colpi - Tricolporate
Number of pollen grains – 22

Plate - 22 Figure - 67

Genus – *Matricaria* Species –
Shape – Oblate spheroidal
Size - 23.6 µ
Pore / colpi - Tricolporate
Number of pollen grains – 15

Plate - 22 Figure- 68

Genus – *Michenia* Species – *micrantha*
Shape –
Size -
Pore / colpi -
Number of pollen grains – 820

Genus – *Senecio* Species –
Shape – Oblate spheroidal
Size - 28.2 µ
Pore / colpi - Tricolporate
Number of pollen grains – 10

Plate - 23 Figure - 69

Genus – *Solidago* Species – *canadensis*
Shape – Oblate spheroidal
Size - 22.4 µ
Pore / colpi - Tricolporate
Number of pollen grains – 51

Plate - 23 Figure - 70

Genus – *Taraxacum* Species –
Shape – Oblate spheroidal
Size - 34.3 µ
Pore / colpi - Tricolporate/Tetracolporate
Number of pollen grains – 92

Plate - 23 Figure - 71

Genus – *Xanthium* Species – *strumarium*
Shape – Spherical
Size - 26.8 µ
Pore / colpi - Tricolporate
Number of pollen grains – 197

Plate – 24 Figure – 73

Genus – *Erica* Species –
Shape –
Size – 32.4 µ
Pore/Colpi – Tricolporate
Number of pollen grains – 29

Plate - 24 Figure – 75

Genus – *Fraxinus* Species – *excelsior*
Shape – Oblate spheroidal
Size - 19.5 µ
Pore / colpi - Tricolporoidate
Number of pollen grains – 5

Plate - 25 Figure - 78

Genus – *Echium* Species – *italicum*
Shape – Prolate
Size - 18.7 µ
Pore / colpi - Tricolporate
Number of pollen grains – 16

Plate - 25 Figure - 79

Genus – *Symphytum* Species – *officinale*
Shape – Prolate
Size - 27.3 µ
Pore / colpi - Stephanocolporate
Number of pollen grains – 32

Plate - 25 Figure - 80

Genus – *Convolvulus* Species – *arvensis*
Shape – Oblate spheroidal
Size - 53.6 µ
Pore / colpi - Tricolporate
Number of pollen grains – 11

Genus – *Pholx* Species – *drummondi*
Shape – Irregularly round
Size - 57.5 µ
Pore / colpi - Pores only
Number of pollen grains - 15

Plate - 26 Figure - 81

Genus – *Antirrhinum* Species – *indicum*
Shape – Oblate spheroidal
Size - 12.5 µ
Pore / colpi - Tricolporate/Syncolporate
Number of pollen grains – 7

Genus – *Linaria* Species – *vulgaris*
Shape – Irregularly round
Size - 14.2 µ
Pore / colpi - Furrows with pores
Number of pollen grains – 14

Plate - 27 Figure - 83

Genus – *Verbena* Species – *officinalis*
Shape – Oblate spheroidal
Size - 25.4 µ
Pore / colpi - Heterocolpate
Number of pollen grains – 4

Plate - 27 Figure - 84

Genus – *Lavandula* Species – *agustifolia*
Shape – Oblate
Size - 25.5 µ
Pore / colpi - Stephanocolpate
Number of pollen grains – 7

Genus – *Lavandula* Species – *stoechas*
Shape – Oblate
Size - 26.2 µ
Pore / colpi - Stephanocolpate
Number of pollen grains – 9

Plate - 28 Figure – 85 - 86

Genus – *Mentha* Species – *pulegium*
Shape – Oblate spheroidal
Size - 18.5 µ
Pore / colpi - Stephanocolpate
Number of pollen grains – 22

Plate - 29 Figure – 87 - 88

Genus – *Rosmarinus* Species –
Shape – Suboblate
Size - 33.2 µ
Pore / colpi - Stephanocolpate
Number of pollen grains – 5

Genus – *Plantago* Species – *lanceolata*
Shape – Spheric
Size - 24.3 µ
Pore / colpi - Periporate
Number of pollen grains – 33

Plate - 30 Figure - 91

Genus – *Chenopodium* Species –
Shape – Spheric
Size - 26.5 µ
Pore / colpi - Periporate
Number of pollen grains – 11

Plate - 30 Figure – 92

Genus – *Fagopyrum* Species – *esculentum*
Shape – Subprolate
Size - 40.4 µ
Pore / colpi - Tricolporate
Number of pollen grains – 4

Plate - 31 Figure – 93 - 94

Genus – *Laurus* Species – *nobilis*
Shape – Spheric
Size - 55.4 µ
Pore / colpi - Inaperturate
Number of pollen grains – 63

Plate - 32 Figure - 96

Genus – *Hippophae* Species – *rhamnoides*
Shape – Irregularly round
Size - 23.4 µ
Pore / colpi - Furrows with pores
Number of pollen grains – 1

Plate - 32 Figure - 97

Genus – *Loranthus* Species –
Shape – Oblate
Size - 15.4 µ
Pore / colpi - Tricolporate/Syncolpate
Number of pollen grains – 1

Plate - 32 Figure - 98

Genus – *Chrozophora* Species –
Shape – Suboblate
Size - 54.6 µ
Pore / colpi - Stephanocolporate
Number of pollen grains – 4

Plate - 33 Figure - 99

Genus – *Urtica* Species – *dioica*
Shape – Irregularly round
Size - 13.8 µ
Pore / colpi - Pores only
Number of pollen grains – 1

Plate - 33 Figure - 100

Genus – *Ulmus* Species – *procera*
Shape – Suboblate
Size - 25.5 µ
Pore / colpi - Stephanocolporate
Number of pollen grains – 13

Plate - 34 Figure - 104

Genus – *Quercus* Species – *robur*
Shape – Oblate spheroidal
Size - 28.4 µ
Pore / colpi - Tricolporoidate
Number of pollen grains – 33

Plate - 34 Figure - 105

Genus – *Populus* Species – *tricocarpa*
Shape –
Size -
Pore / colpi -
Number of pollen grains – 8

Plate - 34 Figure - 106

Genus – *Musa* Species – *paradisiaca*
Shape – Circular
Size - 120.6 µ
Pore / colpi - Inaperturate
Number of pollen grains – 1

Plate - 35 Figure - 108

Genus – *Iris* Species – *unguicularis*
Shape – Round
Size - 78.4 µ
Pore / colpi - Furrows only
Number of pollen grains – 2

Genus – *Asparagus* Species – *acutifolis*
Shape – Oblate
Size - 16.4 µ
Pore / colpi - Monocolpate
Number of pollen grains – 27

Genus – *Smilax* Species – *aspera*
Shape – Spheric
Size - 20.5
Pore / colpi - Inaperturate
Number of pollen grains – 4

Plate - 36 Figure - 111

Genus – *Alopecurus* Species – *pratensis*
Shape – Round
Size - 14.5 µ
Pore / colpi - Pores only
Number of pollen grains – 44

Plate - 36 - 37 Figure – 112 - 113

Genus – *Zea* Species – *mays*
Shape – Round
Size - 70.4 µ
Pore / colpi - Monoulcerate
Number of pollen grains – 277

Plate - 39 Figure - 117

Genus – *Cupressus* Species – *sempevirens*
Shape – Spheroidal
Size - 24.1 µ
Pore / colpi - Monoporate
Number of pollen grains – 1

SUMMER SAMPLES

Kubza Village

Summer samples of honey obtained from Kubza Village of Mokokchung district reveals the presence of following types of pollen grains belonging to various members of respective families in the honey collected by bees. The number of pollen grains is given per ml of honey sample.

Ranunculaceae - *Clematis vitalba*, Papaveraceae - *Papaver rhoes*, Brassicaceae – *Mathiola sp*, Malvaceae - *Gossypium*, Tiliaceae - *Tilia petiolaris*, Geraniaceae - *Geranium pratense, G. rotundifolium*, Aceraceae – *Acer sp*, Platanaceae - *Platanus orientalis*, Fabaceae - Coronilla, *Glycine max, Melilotus alba, Sophora sp*, Caesapinasceae - *Cassia didimobotrya*, Rossaceae - *Filipendula ulmaria*, Myrtaceae - *Myrtus communis*, Cucurbetaceae - *Citrullus lanatus, Cucumis sativus, Cucurbita pepo, Diplotaxis erucoides*, Apiaceae - *Bupleurum fruticosum*, Cornaceae - *Cornus sanguinea*, Caprifoliaceae - *Sambucus nigera*, Asteraceae - *Ambrosia maritime, Chrysanthemum sp, Matricaria sp, Michenia micrantha*, Boraginaceae - *Cynoglossum creticum*, Loranthaceae - *Loranthus europaeus*, Santalaceae - *Thesium humile*, Corylaceae - *Corylus avellana, Carpinus betulus*, Fagaceae - *Fagus sylvatica*, Salicaceae - *Populus tricocarpa*, Musaceae - *Musa paradisiaca*, Amaryllidaceae - *Galanthus nivalis*, Poaceae - *Zea mays*.

Plate - 40 Figure – 1

Genus - *Clematis* Species – *vitalba*
Shape – Suboblate
Size - 20.2 µ
Pore / colpi - Tricolpate
Number of pollen grains – 2

Plate - 40 Figure - 3

Genus - *Papaver* Species – *rhoes*
Shape – Oblate spheroidal
Size - 23.6 µ
Pore / colpi - Tricolpate
Number of pollen grains – 3

Genus – *Mathiola* Species-
Shape – Spheric
Size - 23.5 µ
Pore / colpi - Inaperturate
Number of pollen grains – 19

Genus – *Gossypium* Species-
Shape – Spheric
Size - 123.5 µ
Pore / colpi - Periporate
Number of pollen grains – 10

Plate - 42

Figure - 8

Genus - *Tilia*

Species – *petiolaris*

Shape – Triangular/irregular
Size - 35.6 µ
Pore / colpi - Furows with pores
Number of pollen grains – 2

Plate - 43

Figure - 9

Genus - *Geranium*

Species –*pratense*

Shape – Oblate spheroidal
Size - 45.3 µ
Pore / colpi - Tricolporate
Number of pollen grains – 25

Plate - 43

Figure - 10

Genus - *Geranium*

Species – *rotundifolium*

Shape – Oblate spheroidal
Size - 47.2 µ
Pore / colpi - Tricolporate
Number of pollen grains – 6

Plate - 44

Figure - 12

Genus - *Acer*

Species –

Shape – Oval flattened
Size - 42.8 µ
Pore / colpi - Furrows with pores
Number of pollen grains – 8

Plate - 44 Figure - 14

Genus - *Platanus* Species – *orientalis*
Shape – Subprolate
Size - 24.2 µ
Pore / colpi - Tricolporate
Number of pollen grains – 3

Plate - 45 Figure - 15

Genus - *Coronilla* Species –
Shape – Oblate spheroidal
Size - 27.2 µ
Pore / colpi - Tricolporoidate
Number of pollen grains –

Plate - 45 Figure - 16

Genus - *Glycine* Species – *max*
Shape – Oblate spheroidal
Size - 23.6 µ
Pore / colpi - Tricolporate
Number of pollen grains – 10

Plate - 46 Figure - 19

Genus - *Melilotus* Species – *alba*
Shape – Prolate spheroidal
Size - 23.7 µ
Pore / colpi - Tricolporate
Number of pollen grains – 5

Plate - 46 Figure - 20

Genus - *Sophora* Species- *japonica*
Shape – Prolate
Size - 17.2 µ
Pore / colpi - Tricolporate
Number of pollen grains – 2

Plate - 46 Figure - 21

Genus - *Cassia* Species- *didimobotrya*
Shape –Oblate spheroidal
Size - 34.2 µ
Pore / colpi - Tricolporate
Number of pollen grains – 7

Plate - 46 Figure - 22

Genus - *Filipendula* species- *ulmaria*
Shape – Prolate spheroidal
Size - 19.5 µ
Pore / colpi - Tricolporate
Number of pollen grains – 8

Plate - 47 Figure - 23

Genus - *Myrtus* Species-*communis*
Shape – Oblate
Size - 10.7 µ
Pore / colpi - Tricolporate/Syncolpate
Number of pollen grains – 2

Plate -47 Figure - 26

Genus - *Citrullus* Species-*lanatus*
Shape – Oblate spheroidal
Size - 52.4 µ
Pore / colpi - Tricolporate
Number of pollen grains –

Plate - 47 Figure – 25

Genus – *Cucumis* Species-*sativus*
Shape – Oblate spheroidal
Size - 45.5 µ
Pore / colpi - Triporate
Number of pollen grains –

Plate -47 Figure - 24

Genus - *Cucurbita* species- *pepo*
Shape – Spheric
Size - 115.7 µ
Pore / colpi - Periporate
Number of pollen grains – 6

Genus – *Diplotaxis* Species-*erucoides*
Shape – Subprolate
Size - 26.4 µ
Pore / colpi - Tricolpate
Number of pollen grains – 2

Plate - 48

Figure - 27

Genus – *Bupleurum*
Species – *fruticosum*

Shape – Prolate
Size - 18.4 µ
Pore / colpi - Tricolporate
Number of pollen grains – 14

Plate - 48

Figure - 28

Genus - *Cornus*
Species –*sanguinea*

Shape – Prolate spheroidal
Size - 54.3 µ
Pore / colpi - Tricolporate
Number of pollen grains – 1

Genus - *Sambucus*
Species – *nigera*

Shape – Suboblate
Size - 17.9 µ
Pore / colpi - Tricolporoidate
Number of pollen grains – 2

Plate - 48

Figure - 29

Genus - *Ambrosia*
Species – *maritima*

Shape – Suboblate
Size - 18.3 µ
Pore / colpi - Tricolporate
Number of pollen grains – 16

Plate - 49 Figure - 31

Genus – *Chrysanthemum* Species –
Shape –
Size -
Pore / colpi -
Number of pollen grains – 28

Plate - 49 Figure – 33 - 34

Genus - *Matricaria* Species –
Shape – Oblate spheroidal
Size - 23.6 µ
Pore / colpi - Tricolporate
Number of pollen grains – 20

Plate - 50 Figure - 35

Genus - *Michenia* Species – *micrantha*
Shape –
Size -
Pore / colpi -
Number of pollen grains – 12

Plate - 50 Figure - 36

Genus - *Cynoglossum* Species –*creticum*
Shape – Prolate
Size - 18.5 µ
Pore / colpi - Stephanocolporate
Number of pollen grains – 7

Plate - 50 Figure - 38

Genus - *Loranthus* Species – *europaeus*
Shape – Oblate
Size - 15.4 µ
Pore / colpi - Tricolporate/Syncolporate
Number of pollen grains – 1

Genus - *Thesium* Species – *humile*
Shape – Oblate spheroidal
Size - 22.6 µ
Pore / colpi - Trichotomonocolpate
Number of pollen grains – 2

Genus - *Corylus* Species – *avellana*
Shape – Triangular
Size - 29.3 µ
Pore / colpi - pores only
Number of pollen grains – 12

Plate - 51 Figure - 42

Genus – *Carpinus* Species – *betulus*
Shape – Irregularly round
Size - 32.6 µ
Pore / colpi - pores only
Number of pollen grains – 5

Plate - 52

Figure - 43

Genus - *Fagus*

Species – *sylvatica*

Shape – Irregularly round
Size - 43.4 µ
Pore / colpi - Furrows with pores
Number of pollen grains – 11

Plate - 52

Figure - 44

Genus - *Populus*

Species – *nigra*

Shape – Spheric
Size - 26.2 µ
Pore / colpi - Periporate
Number of pollen grains – 11

Plate - 52

Figure - 46

Genus - *Musa*

Species – *paradisiaca*

Shape – Circular
Size - 120.6 µ
Pore / colpi - Inaperturate
Number of pollen grains – 2

Plate - 53

Figure - 48

Genus - *Galanthus*

Species – *nivalis*

Shape – Boat shaped
Size - 27.3 µ
Pore / colpi - Furrows only
Number of pollen grains – 1

Plate - 54 Figure - 51

Genus - *Zea* Species – *mays*
Shape – Round
Size - 70.4 µ
Pore / colpi - Monoulcerate
Number of pollen grains – 4

Khensa Village

Summer samples of honey obtained from Khensa Village of Mokokchung district reveal the presence of following types of pollen grains belonging to various members of respective families in the honey collected by the bees of *Apis indica.*

Ranunculaceae - *Ranunculus bulbosus*, Brassicaceae - *Diplotaxis erocoides*, Malvaceae - *Hibiscus rosa - sinensis*, Tiliaceae -*Tilia petiolaris*, Geraniaceae - *Geranium rotundifolium*, Hippocastanaceae - *Aesculus hippocastanum*, Platanaceae - *Platanus orientalis*, Fabaceae - *Glycine max, Phaseolus coccineus, Robinia pseudoacacia*, Caesalpiniaceae - *Cassia didimobotrya*, Rosaceae - *Filipendula ulmaria*, Myrtaceae - *Eucalyptus gunnii*, Cucurbitaceae - *Cucumis sativus*, Apiaceae - *Bupleurum fruticosum*, Asteraceae – *Artemesia vulgaris, Chrysanthemum sp, Michenia micrantha*, Polyganaceae - *Fagopyrum esculentum*, Santalaceae - *Thesium humile*, Euphorbiaceae - *Mercurialis perennis, Cotoneaster horizontalis*, Corylaceae - *Corylus avellena*, Fagaceae - *Facus sylvatica*, Thypaceae - *Thypa angustifolia*, Musaceae - *Musa paradisiaca, Iridaceae - Iris pseudoacorus*, Liliaceae - *Allium cepa*, Poaceae - *Alopecurus pratensis, Zea mays*

Genus – *Ranunculus* Species – *bulbosus*
Shape – Suboblate
Size – 28.5 µ
Pore/Colpi – Tricolpate
Number of pollen grains – 8

Plate – 41 Figure – 5

Genus – *Diplotaxis* Species – *erocoides*
Shape – Subprolate
Size – 26.4 µ
Pore/Colpi – Tricolpate
Number of pollen grains – 2

Plate – 41 - 42 Figure – 6 - 7

Genus – *Hibiscus* Species – *rosa-sinensis*
Shape – Spheric
Size – 147.5 µ
Pore/Colpi – 24
Number of pollen grains –

Plate – 42 Figure – 8

Genus – *Tilia* Species – *petiolaris*
Shape – Triangular/irregular
Size – 35.6 µ
Pore/Colpi – Furrows with pores
Number of pollen grains – 5

Plate – 43 Figure – 10

Genus – *Geranium* Species – *rotundifolium*
Shape – Oblate spheroidal
Size – 45.3 µ
Pore/Colpi – Tricolporate
Number of pollen grains – 23

Plate – 44 Figure – 11

Genus – *Aesculus* Species – *hippocastanum*
Shape – Prolate spheroidal
Size – 18.5 µ
Pore/Colpi – Tricolporate
Number of pollen grains – 3

Plate – 44 Figure – 14

Genus – *Platanus* Species – *orientalis*
Shape – Subprolate
Size – 24.2 µ
Pore/Colpi – Tricolporate
Number of pollen grains – 7

Plate – 45 Figure – 16

Genus – *Glycine* Species – *max*
Shape – Oblate spheroidal
Size – 23.6 µ
Pore/Colpi – Tricolporate
Number of pollen grains – 1

Plate – 45 Figure – 17

Genus – *Phaseolus* Species – *coccineus*
Shape – Irregularly round
Size – 32.5 µ
Pore/Colpi – Pores only
Number of pollen grains – 6

Plate – 45 Figure – 18

Genus – *Robinia* Species – *pseudoacacia*
Shape – Suboblate
Size – 24.5 µ
Pore/Colpi – Tricolporate/tricolporoidate
Number of pollen grains – 3

Plate – 46 Figure – 21

Genus – *Cassia* Species – *didimobotrya*
Shape – Oblate spheroidal
Size – 34.2 µ
Pore/Colpi – Tricolporate
Number of pollen grains – 2

Plate – 46 Figure – 22

Genus – *Filipendula* Species – *ulmaria*
Shape – Prolate spheroidal
Size – 19.5 µ
Pore/Colpi – Tricolporate
Number of pollen grains – 7

Genus – *Eucalyptus* Species – *gunnii*
Shape – Oblate
Size – 13.5 µ
Pore/Colpi – Tricolporate/Syncolpate
Number of pollen grains – 1

Plate – 47 Figure – 25

Genus – *Cucumis* Species – *sativus*
Shape – Oblate spheroidal
Size – 45.5 µ
Pore/Colpi – Triporate
Number of pollen grains – 3

Plate – 48 Figure – 27

Genus – *Bupleurum* Species – *fruticosum*
Shape – Prolate
Size – 26.4 µ
Pore/Colpi – Tricolpate
Number of pollen grains – 4

Plate – 48 Figure – 30

Genus – *Artemesia* Species – *vulgaris*
Shape – Oblate spheroidal
Size – 19.6 µ
Pore/Colpi – Tricolpate
Number of pollen grains –

Plate – 49 Figure – 31

Genus – *Chrysanthemum* Species –
Shape –
Size –
Pore/Colpi –
Number of pollen grains – 4

Plate – 50 Figure – 35

Genus – *Michenia* Species – *micrantha*
Shape –
Size –
Pore/Colpi –
Number of pollen grains –

Plate – 50 Figure – 37

Genus – *Fagopyrum* Species – *esculentum*
Shape – Subprolate
Size – 40.4 µ
Pore/Colpi – Tricolporate
Number of pollen grains – 6

Genus – *Thesium* Species – *humile*
Shape – Oblate spheroidal
Size – 22.6 µ
Pore/Colpi – Trichotomonocolpate
Number of pollen grains – 8

Plate – 51 Figure – 39

Genus – *Mercurialis* Species – *perennis*
Shape – Prolate spheroidal
Size – 24.3 µ
Pore/Colpi – Tricolporate
Number of pollen grains – 1

Genus – *Corylus* Species – *avellena*
Shape – Triangular
Size – 29.3 µ
Pore/Colpi – Pores only
Number of pollen grains – 7

Plate – 52 Figure – 43

Genus – *Fagus* Species – *sylvatica*
Shape – Irregularly round
Size – 43.4 µ
Pore/Colpi – Furrows with pores
Number of pollen grains – 3

Genus – *Thypha* Species – *angustifolia*

Shape – Oblate
Size – 18.3
Pore/Colpi – Monoporate
Number of pollen grains – 2

Plate – 52 Figure – 46

Genus – *Musa* Species – *paradisiaca*
Shape – Circular
Size – 120.6 µ
Pore/Colpi – Inaperturate
Number of pollen grains – 1

Genus – *Iris* Species – *pseudoacorus*
Shape – Round
Size – 78.4 µ
Pore/Colpi – Furrows only
Number of pollen grains – 4

Plate – 53 Figure – 49

Genus – *Allium* Species – *cepa*
Shape – Oblate
Size – 18.5 µ
Pore/Colpi – Monocolpate
Number of pollen grains – 26

Plate – 54 Figure – 50

Genus – *Alopecurus* Species – *pratensis*
Shape – Round
Size – 47.5 µ
Pore/Colpi – Pores only
Number of pollen grains – 2

Plate – 54 Figure – 51

Genus – *Zea* Species – *mays*
Shape – Round
Size – 70.4 µ
Pore/Colpi – Monoulcerate
Number of pollen grains – 1

Ungma Village

Summer samples of honey obtained from Ungma Village of Mokokchung district reveal the presence of following types of pollen grains belonging to various members of respective families in the honey collected by the bees of *Apis indica*. The number of pollen grains is given per ml of honey sample.

Magnoliaceae - *Liriodendron tulipefera*, Papaveraceae - *Papaver rhoes*, Brassicaceae - *Brassica napus*, Malvaceae - *Abutilon indicum*, *Hibiscus rosa- sinensis*, Geraniaceae - *Geranium rotundifolium*, Hippocastanaceae - *Aesculus hippocastanum*, *Aceraceae – Acer sp*, Anacardiaceae - *Cotinus*, Fabaceae - *Ceratonia siliqua*, *Phaseolus coccineus*, *Robinia pseudoacacia*, Rosaceae - *Eriobotrya japonica*, *Filipendula ulmaria*, Myrtaceae - *Eucalyptus gunnii*, Cucurbitaceae - *Cucumis sativus*, Apiaceae - *Bupleurum fruticosum*, Asteraceae - *Artemesia vulgaris*, *Chrysanthemum sp*, *Helianthus annuus*, *Michenia micrantha*, Boraginaceae - *Cynoglossum creticum*, Scrophulariaceae - *Antirrhinum majus*, Polygonaceae - *Fagopyrum esculentum*, Euphorbiaceae – *Mercurialis sp*, *Cotoneaster horizontalis*, Urticaceae - *Urtica dioica*, Juglandaceae - *Juglans*, Salicaceae - *Salix triandra*, *Populus tricocarpa*, Thyphaceae - *Thypha Agustifolia*, Musaceae - *Musa paradisiaca*, Iridaceae - *Crocosmia*, Liliaceae - *Allium cepa*.

Plate – 40

Figure – 2

Genus – *Liriodendron*

Species – *tulipifera*

Shape – Suboblate
Size – 51.6 µ
Pore/Colpi – Monocolpate
Number of pollen grains – 6

Plate – 40 Figure – 3

Genus – *Papaver* Species – *rhoes*
Shape – Oblate spheroidal
Size – 23.6 µ
Pore/Colpi – Tricolpate
Number of pollen grains – 12

Plate – 40 Figure - 4

Genus – *Brassica* Species – *napus*
Shape – Oblate spheroidal
Size – 24.7 µ
Pore/Colpi – Tricolpate
Number of pollen grains – 11

Genus – *Abutilon* Species – *indicum*
Shape – Suboblate
Size – 58.3 µ
Pore/Colpi – Tricolporate
Number of pollen grains – 3

Plate – 41 - 42 Figure – 6 - 7

Genus – *Hibiscus* Species – *rosa -sinensis*
Shape – Spheric
Size – 147.5 µ
Pore/Colpi – Periporate
Number of pollen grains – 25

Plate – 43 Figure – 10

Genus – *Geranium* Species – *rotundifolium*
Shape – Oblate spheroidal
Size – 45.3 μ
Pore/Colpi – Tricolporate
Number of pollen grains – 9

Plate – 44 Figure – 11

Genus – *Aesculus* Species – *hippocastanum*
Shape – Prolate spheroidal
Size – 18.5 μ
Pore/Colpi – Tricolporate
Number of pollen grains – 15

Plate – 44 Figure – 12

Genus – *Acer* Species –
Shape – Oval flattened
Size – 42.8 μ
Pore/Colpi – Furrows with pores
Number of pollen grains – 8

Plate – 44 Figure – 13

Genus – *Cotinus* Species –
Shape – Prolate spheroidal
Size – 24.2 μ
Pore/Colpi – Tricolporate
Number of pollen grains – 5

Genus – *Ceratonia* Species –
Shape – Oblate spheroidal
Size – 23.5 µ
Pore/Colpi – Tetracolporate
Number of pollen grains – 4

Plate – 45 Figure –17

Genus – *Phaseolus* Species – *coccineus*
Shape – Irregularly round
Size – 32.5 µ
Pore/Colpi – Pores only
Number of pollen grains – 9

Plate – 45 Figure – 18

Genus – *Robinia* Species – *pseudacacia*
Shape – Suboblate
Size – 24.5 µ
Pore/Colpi – Tricolporate/tricolporoidate
Number of pollen grains – 3

Genus – *Eriobotrya* Species – *japonica*
Shape – Suboblate
Size – 24.4 µ
Pore/Colpi – Tricolporoidate
Number of pollen grains – 7

Plate – 46 Figure – 22

Genus – *Filipendula* Species – *ulmaria*
Shape – Prolate spheroidal
Size – 19.5 μ
Pore/Colpi – Tricolporate
Number of pollen grains – 6

Genus – *Eucalyptus* Species – *gunnii*
Shape – Oblate
Size – 13.5
Pore/Colpi – Tricolporate/syncolpate
Number of pollen grains – 2

Plate – 47 Figure – 25

Genus – *Cucumis* Species – *sativus*
Shape – Oblate spheroidal
Size – 45.5 μ
Pore/Colpi – Triporate
Number of pollen grains – 4

Plate – 48 Figure – 27

Genus – *Bupleurum* Species – *fruticosum*
Shape – Prolate
Size – 18.4 μ
Pore/Colpi – Tricolporate
Number of pollen grains – 25

Plate – 48 Figure – 30

Genus – *Artemesia* Species – *vulgaris*
Shape – Oblate spheroidal
Size – 19.6 μ
Pore/Colpi – Tricolporate
Number of pollen grains – 10

Plate – 49 Figure – 31

Genus – *Chrysanthemum* Species –
Shape –
Size –
Pore/Colpi –
Number of pollen grains – 25

Plate – 49 Figure – 32

Genus – *Helianthus* Species – *annuus*
Shape – Oblate spheroidal
Size – 38.
Pore/Colpi – Tricolporate
Number of pollen grains – 31

Plate – 50 Figure – 35

Genus – *Michenia* Species – *micrantha*
Shape –
Size –
Pore/Colpi –
Number of pollen grains – 14

Plate – 50 Figure – 36

Genus – *Cynoglossum* Species – *creticum*
Shape – Prolate
Size – 18.5 µ
Pore/Colpi – Stephanocolporate
Number of pollen grains – 54

Genus – *Antirrhinum* Species – *majus*
Shape – Oblate spheroidal
Size – 12.5 µ
Pore/Colpi – Tricolporate/syncolpate
Number of pollen grains – 3

Plate – 50 Figure – 37

Genus – *Fagopyrum* Species – *esculentum*
Shape – Subprolate
Size – 40.4 µ
Pore/Colpi – Tricolporate
Number of pollen grains – 19

Plate – 51 Figure – 39

Genus – *Mercurialis* Species –
Shape – Prolate spheroidal
Size – 24.3 µ
Pore/Colpi – Tricolporate
Number of pollen grains – 2

Plate – 51 Figure – 40

Genus – *Urtica* Species – *dioica*
Shape – Irregularly round
Size – 13.8 μ
Pore/Colpi – Pores only
Number of pollen grains – 8

Plate – 51 Figure – 41

Genus – *Juglan* Species –
Shape –
Size –
Pore/Colpi –
Number of pollen grains – 4

Plate – 52 Figure – 45

Genus – *Salix* Species – *triandra*
Shape – Subprolate
Size – 18.4 μ
Pore/Colpi – Tricolporate
Number of pollen grains –

Plate – 52 Figure – 44

Genus – *Populus* Species – *tricocarpa*
Shape – Spheric
Size – 26.2 μ
Pore/Colpi – Periporate
Number of pollen grains – 19

Genus – *Thypha* Species – *angustifolia*
Shape – Oblate
Size – 18.3
Pore/Colpi – Monoporate
Number of pollen grains – 6

Plate – 52 Figure – 46

Genus – *Musa* Species – *paradisiaca*
Shape – Circular
Size – 120.6 µ
Pore/Colpi – Inaperturate
Number of pollen grains – 5

Plate – 53 Figure – 47

Genus – *Crocosmia* Species –
Shape – Oval flattened/semi circular
Size – 66.8 µ
Pore/Colpi – Furrows only
Number of pollen grains – 11

Plate – 53 Figure – 49

Genus – *Allium* Species – *cepa*
Shape – Oblate
Size – 18.5 µ
Pore/Colpi – Monopolate
Number of pollen grains – 5

MARKET SAMPLES

Market samples of honey obtained from Mokokchung district reveal the presence of following types of pollen grains belonging to various members of respective families in the honey collected by the bees of *Apis indica*. The number of pollen grains is given per ml of honey sample.

Brassicaceae - *Brassica napus*, Capparidaceae - *Capparis spinosa*, Violaceae - *Viola tricolor*, Balsaminaceae - *Impatiens glandulifera*, Meliaceae - *Melia azedarach*, Fabaceae - *Glycine max*, *Melilotus alba*, *Ononis pubescens*, *Trifolium pretense*, Rosaceae - *Prunus domestica*, Cucurbitaceae - *Cucumis sativus*, Apiaceae - *Bupleurum fruticosum*, Boraginaceae - *Alkanna tinctoria*, *Echium italicum*, Convolvulaceae - *Convolvulus arvensis*, Lauraceae - *Laurus nobilis*, Fagaceae - *Castanea sativa*, Liliaceae - *Asparagus acutifolius*.

Plate – 55 Figure – 1

Genus – *Brassica* Species – *napus*
Shape - Oblate spheroidal
Size - 24.7 µ
Pore/Colpi - Tricolporate
Number of pollen grains – 1

Genus – *Capparis* Species – *spinosa*
Shape - Prolate spheroidal
Size - 29.5 µ
Pore/Colpi - Tricolpate
Number of pollen grains – 3

Genus – *Viola* Species – *tricolor*
Shape - Multisided or irregular
Size - 80.4 µ
Pore/Colpi – Furrows with pores
Number of pollen grains – 2

Plate – 55 Figure – 2

Genus – *Impatiens* Species – *glandulifera*
Shape - Long
Size - 42.7 µ
Pore/Colpi – Furrows only
Number of pollen grains – 1

Genus – *Melia* Species – *azedarach*
Shape - Oblate spheroidal
Size - 39.5 µ
Pore/Colpi - Tetracolporate
Number of pollen grains – 1

Plate – 55 Figure – 3

Genus – *Glycine* Species – *max*
Shape - Oblate spheroidal
Size - 23.6 µ
Pore/Colpi - Tricolporate
Number of pollen grains – 1

Plate – 55 Figure – 4

Genus – *Melilotus* Species – *alba*
Shape - Prolate spheroidal
Size - 23.7 µ
Pore/Colpi - Tricolporate
Number of pollen grains – 3

Genus – *Ononis* Species – *pubescens*
Shape - Prolate
Size - 38.6 µ
Pore/Colpi - Tricolporate
Number of pollen grains – 1

Genus – *Trifolium* Species – *pratense*
Shape - Prolate spheroidal
Size - 42.4 µ
Pore/Colpi - Tricolporate
Number of pollen grains – 3

Plate – 56 Figure – 5

Genus – *Prunus* Species – *domestica*
Shape - Suboblate
Size - 43.4 µ
Pore/Colpi - Tricolporoidate
Number of pollen grains – 1

Genus – *Cucumis* Species – *sativus*
Shape - Oblate spheroidal
Size - 45.5 μ
Pore/Colpi - Triporate
Number of pollen grains – 1

Plate – 56 Figure – 6

Genus – *Bupleurum* Species – *fruticosum*
Shape - Prolate
Size - 18.4 μ
Pore/Colpi - Tricolporate
Number of pollen grains – 7

Plate – 56 Figure – 7

Genus – *Alkanna* Species – *tinctoria*
Shape - Prolate
Size - 12.5 μ
Pore/Colpi - Tricolporate
Number of pollen grains – 1

Genus – *Echium* Species – *italicum*
Shape - Prolate
Size - 18.7 μ
Pore/Colpi - Tricolporate
Number of pollen grains – 2

Plate – 56 Figure – 8

Genus – *Convolvulus* Species – *cantabrica*
Shape - *Oblate spheroidal*
Size - 53.6 µ
Pore/Colpi - Tricolpate
Number of pollen grains – 2

Genus – *Laurus* Species – *nobilis*
Shape - Spheric
Size - 55.4 µ
Pore/Colpi - Inaperturate
Number of pollen grains – 2

Genus – *Castanea* Species – *sativa*
Shape - Prolate
Size - 15.7 µ
Pore/Colpi - Tricolporate
Number of pollen grains – 8

Genus – *Asparagus* Species – *acutifolius*
Shape - Oblate
Size - 16.4 µ
Pore/Colpi - Monocolpate
Number of pollen grains – 1

Table – 1. Showing the names of families, genera, species and the number of respective pollen present in the winter honey sample of kubza village per 10 gms

Sl.No.	Family	Genera	Species	No. of Pollen grains
1	Ranunculaceae	*Clematis*	*vitalba*	80
		Helleborous	*niger*	10
2	Magnoliaceae	*Magnolia*	*grandiflora*	90
3	Brassicaceae	*Brassica*	*napus*	630
4	Violaceae	*Viola*	*tricolor*	5790
5	Cauyophyllaceae	*Stellaria*	*media*	90
		Spergularia	*rupicola*	80
6	Cistaceae	*Helianthemum*	*chamaecistis*	10
7	Malvaceae	*Hibiscus*	*rosa sinensis*	170
		Abutilon	*theophrasti*	80
8	Convolvulaceae	*Convolvulus*	*cantribrica*	40
9	Geraniaceae	*Geranium*	*rotuntifolium*	110
10	Balsaminaceae	*Impatiens*	*glandulifera*	210
11	Rutaceae	*Citrius*	*limon*	230
12	Vitaceae	*Vitis*	*vinifera*	80
13	Hippocastanaceae	*Aesculus*	*hippocastanum*	20
14	Anarcardiaceae	*Pistacia*	*lentiscus*	40
15	Platanaceae	*Platanus*	*orientalis*	30
		Acacia	*dealbata*	310
16	Fabaceae	*Ulex*	*galli*	60
		Ulex	*europacus*	60
		Erythrina	*indica*	60

		Demodium	*sp*	
		Ononis	*pubescens*	40
		Lupinus	*albus*	50
17	Caesalpinaceae	*Cassia*	*didimobotrya*	100
18	Rosaceae	*Malus*	*domestica*	70
		Pyrus	*communis*	800
		Prunus	*dulcis*	980
19	Crassulaceae	*Sedum*	*acre*	20
20	Myrtaceae	*Eucalyptus*	*gunii*	390
21	Passifloraceae	*Passiflora*	*eduli*	50
22	Cucurbitaceae	*Ecballium*	*elaterium*	140
		Citrullus	*lanatus*	150
23	Apiaceae	*Bupleurum*	*froticosum*	210
24	Araliaceae	*Hedera*	*helix*	60
25	Cornaceae	*Cornus*	*sanguinea*	450
26	Asteraceae	*Ageratum*	*conyzoides*	3400
		Arctium	*sp*	490
		Carduus	*sp*	10000
		Carthamus	*sp*	70
		Cirsium	*sp*	2400
		Eupatorium	*sapoicum*	300
		Helianthus	*annuus*	5990
		Inula	*sp*	1700
		Matricaria	*sp*	510
		Michenia	*micranths*	5170

		Senecio	*sp*	130
		Solidago	*canadensis*	
27	Ebenaceae	*Diospyros*	*kaki*	20
28	Oleaceae	*Fraxinus*	*excelsior*	50
29	Boraginaceae	*Cynoglossum*	*creticum*	130
		Syniphytum	*officinal*	40
		Alkanna	*tinctoria*	100
30	Convolvulaceae	*Convolvulus*	*contabrica*	40
31	Polemoniaceae	*Phlox*	*drummondii*	70
32	Scrophulariaceae	*Antirrhinum*	*majus*	160
		Verbena	*thapsus*	100
		Linaria	*vulgaris*	30
33	Verbenaceae	*Verbena*	*officinalis*	70
34	Lamiaceae	*Thymus*	*sp*	120
		Lavandula	*agustifolia*	20
		Rosmarinus	*sp*	10
		Teucrium	*sp*	10
35	Plantaginaceae	*Plantago*	*lanceolata*	37
36	Polygonaceae	*Fagopyrom*	*esculentum*	10
37	Lauraceae	*Laurus*	*sp*	30
38	Thymelacaceae	*Daphne*	*gnidium*	20
39	Elaeagnaceae	*Hippophae*	*rhamnoides*	10
40	Loranthaceae	*Loranthus*	*sp*	30
41	Euphorbiaceae	*Chrozophora*	*sp*	110
42	Urticaceae	*Urtica*	*dioica*	10

43	Ulmaceae	*Ulmus*	*procera*	160
44	Betulaceae	*Alnus*	*glutinosa*	50
45	Fagaceae	*Quercus*	*robur*	43
46	Musaceae	*Musa*	*paradisiaca*	20
47	Iridaceae	*Iris*	*unguicularis*	30
48	Liliaceae	*Allium*	*sphaerocephalum*	320
		Asparagus	*acutifolius*	230
49	Smilacaceae	*Smilax*	*aspera*	40
50	Poaceae	*Alopecurus*	*pratensis*	20
51	Pinaceae	*Pines*	*sylvestris*	20
52	Cupressaceae	*Cupressus*	*sempervirens*	50

Table – 2. Showing the names of families, genera, species and the number of respective pollen present in the winter honey sample of Ungma village per 10 gms

Sl.No.	Family	Genera	Species	No. of Pollen grains
1	Ranunculaceae	*Helleborus*	*niger*	70
		Clematis	*vitalba*	110
2	Magnoliaceae	*Magnolia*	*grandiflora*	260
		Liriodendron	*tulipifera*	20
3	Berberidaceae	*Berberis*	*darwinii*	700
4	Papaveraceae	*Hypecoum*	*procumben*	80
5	Brassicaceae	*Brassica*	*napus*	580
		Cardamine	*pratensis*	500
		Brassica	*oleifera*	680
6	Violaceae	*Viola*	*tricolor*	1060

7	Cayophyllaceae	*Lychnis*	*flos-cuculi*	40
8	Tamaricaceae	*Tamarix*	*sp*	50
9	Malvaceae	*Hibiscus*	*rosa sinensis*	120
		Malva	*sylvestries*	20
10	Tiliaceae	*Tilea*	*petiolories*	230
11	Geraniaceae	*Geranium*	*rotuntifolium*	110
		Geranium	*Pratense*	100
12	Oxalidaceae	*Oxalis*	*articulata*	10
13	Rutaceae	*Citrus*	*limon*	50
14	Vitaceae	*Vitis*	*vinifora*	890
		Parthenocissus	*tricuspidate*	950
15	Aceraceae	*Acer*	*pseudoplatanus*	10
16	Anarcardiaceae	*Pistacia*	*lentiscus*	30
17	Platanaceae	*Platanus*	*orientalis*	35
18	Fabaceae	*Calycotone*	*spinosa*	220
		Ceratonia	*siliqua*	200
		Coronilla	*emeros*	260
		Colutea	*arborescens*	700
		Gleditsia	*triancanthus*	270
		Lupinus	*albus*	310
		Onobrychis	*vicifalia*	290
		Medicago	*sativa*	90
		Ononis	*pubescens*	470
		Ononis	*spinosa*	420
		Vicia	*sp*	310

		Vicia	*faba*	20
		Sophora	*japonica*	1430
		Trifolium	*alexandrinum*	540
		Acacia	*dealbata*	390
		Erythrina	*indica*	270
		Desmodium	*sp*	450
19	Caesalpinaceae	*Cassia*	*didmobotrya*	390
20	Rosaceae	*Malus*	*domestica*	900
		Crataegus	*monogyna*	600
		Prunus	*dulcis*	810
		Pyrus	*communis*	1180
21	Crassulaceae	*Sedum*	*acre*	520
22	Myrtaceae	*Myrtus*	*communis*	1410
		Eucalyptus	*gunii*	1980
23	Passifloraceae	*Passiflora*	*edulis*	100
24	Cucurbitaceae	*Bryonia*	*dioica*	120
		Citrullus	*lanatus*	120
		Cucurbita	*Pepo*	10
25	Apiaceae	*Bupleurum*	*fruticosum*	220
26	Araliaceae	*Hedera*	*helix*	230
27	Cornaceae	*Cornus*	*sangrinea*	800
28	Asteraceae	*Ageratum*	*conycoides*	1960
		Aster	*sp*	2030
		Carduus	*sp*	410
		Carthamus	*sp*	1480

		Eupatorium	*sp*	2420
		Helianthus	*sp*	1040
		Inula	*sp*	370
		Michenia	*sp*	6200
		Solidago	*sp*	880
		Taraxacum	*officinale*	980
		Xanthtium	*italicum*	2490
29	Ericaceae	*Arbutus*	*unedo*	10
		Eorica	*sp*	410
30	Plumbeginaceae	*Armeria*	*maritima*	720
31	Ebenaceae	*Diospyros*	*kaki*	50
32	Oleaceae	*Fraxinus*	*Excelsior*	20
33	Buddejaceae	*Buddleja*	*davidii*	130
34	Boraginaceae	*Symphytum*	*officinale*	430
		Alkanna	*tinctoria*	160
		Borogo	*officinalis*	140
35	Convolvulaceae	*Convolvulus*	*cantabrica*	180
36	Polemoniaceae	*Phlox*	*drummondii*	140
37	Schrophulariaceae	*Verbascum*	*thapsus*	10
		Linaria	*vulgaris*	40
38	Verbenaceae	*Verbena*	*officinalis*	40
39	Lamiaceae	*Thymus*	*sp*	220
		Lavandula	*stoechas*	20
		Mentha	*pulegium*	220
		Teucrium	*sp*	10

40	Plantaginaceae	*Plantago*	*lanceolata*	60
41	Chenopodiaceae	*Chenopodium*	*sp*	160
42	Polyfonaceae	*Fagopyrum*	*esculentum*	60
43	Lauraceae	*Laurus*	*nobilis*	810
44	Lornthaceae	*Loranthus*	*sp*	20
45	Euphorbiaceae	*Chrozophora*	*sp*	100
46	Urticaceae	*Urtica*	*dioica*	60
47	Ulmaceae	*Ulmus*	*procera*	40
48	Betulaceae	*Alnus*	*futinosa*	10
49	Fagaceae	*Quercus*	*rubur*	210
50	Liliaceae	*Allium*	*sphaerocepalum*	440
		Asphodelus	*microcarpus*	30
		Asparacus	*acutifolius*	350
51	Poaceae	*Zea*	*mays*	2310
52	Pinaceae	*Pinus*	*insularis*	20

Table – 3 showing the names of families, genera, species and the number of respective pollen present in the winter honey sample of Khensa village per 10 gms

Sl.No.	Family	Genera	Species	No. of Pollen grains
1	Ranunculaceae	*Helleborus*	*niger*	150
2	Magnoliaceae	*Magnolia*	*grandflora*	280
3	Berberidaceae	*Berberis*	*darwinii*	430
4	Brassicaceae	*Brassica*	*napu*	22
		Candamin	*pratensis*	290
5	Violaceae	*Viola*	*tricolor*	800

6	Caryophyllaceae	*Lychnis*	*flos – cuculi*	70
7	Malvaceae	*Abutilen*	*indicum*	10
		Hisbiscus	*rosa – sinensis*	220
8	Tiliaceae	*Tilia*	*petiolaris*	130
9	Geraniaceae	*Geranium*	*rotuntifoloous*	200
		Gerantum	*pratense*	130
10	Oxalidaceae	*Oxalis*	*articulate*	130
11	Balsaminaceae	*Impatiens*	*glandulifera*	130
12	Rutaceae	*Citrus*	*limon*	210
13	Vitaceae	*Vitis*	*sp*	
		Perthenocissus	*tricuspidata*	390
14	Anarcaudiaceae	*Pistacia*	*lentiscus*	10
15	Platanaceae	*Platacia*	*orientalis*	210
		Acacia	*dealbata*	460
16	Fabaceae	*Colutea*	*arborescens*	45
		Gleditsa	*iniancanthus*	350
		Onoprychis	*vicifolia*	100
		Ononsi	*pubescens*	370
		Sophora	*taponica*	370
		Vlex	*gall*	70
17	Caesalpinaceace	*Casesia*	*didimobotrya*	370
18	Rosaceae	*Eriobotrya*	*japonica*	390
		Malus	*domestica*	520
		Prunus	*dulcis*	640
		Crataegus	*monogyna*	37

		Pyrus	*communis*	650
19	Myrtaceae	*Myrtus*	*communis*	1000
20	Passifloraceae	*Passiflora*	*edulis*	30
21	Cucurbitaceae	*Bryonia*	*dioica*	150
		Citrullus	*lanatus*	200
		Ecballium	*elaterium*	300
22	Apiaceae	*Bupleureum*	*fruticosum*	310
		Smyrnium	*olusatrum*	20
23	Araliacae	*Hetera*	*helix*	20
24	Cornaceae	*Cornus*	*sanguinea*	730
25	Asteraceae	*Ageratum*	*conyzoides*	5080
		Aster	*sp*	3330
		Cartuns	*sp*	1500
		Carthamus	*sp*	170
		Circium	*sp*	120
		Eupatorium	*sp*	1030
		Inula	*sp*	220
		Heloanthus	*sp*	2750
		Michenia	*sp*	150
		Senecio	*sp*	100
		Solidago	*sp*	510
		Taraxacum	*officinale*	920
		Xanthium	*italicum*	1370
26	Ericaceae	*Erica*	*sp*	290
	Oleaceae	*Fraxinus*	*excelsior*	50

27	Boraginaceae	*Echium*	*italicum*	160
		Symphytum	*officinale*	320
28	Convolvulaceae	*Covolvulus*	*cantabrica*	110
29	Polemoniaceae	*Phlox*	*drummondii*	150
30	Srophuloriaceae	*Anthinumm*	*majus*	70
		Lianaria	*vulgarias*	140
31	Verbenaceae	*Verbena*	*officinalis*	40
32	Lamiaceae	*Havandula*	*ajustifolia*	70
		Lavantula	*stoechas*	90
		Mentha	*pulegium*	220
		Rosmarinos	*sp*	50
33	Plantaginaceae	*Plantago*	*lanceolata`*	330
34	Chenopodiaceae	*Chenopodium*	*sp*	110
35	Polygonaceae	*Fagopyrum*	*esculentum*	40
36	Lauraceae	*Laurus*	*nobilis*	360
37	Elaeagnaceae	*Hippophae*	*rhamnoides*	10
38	Loranthaceae	*Lorathus*	*sp*	10
39	Eubhorbiaceae	*Chrozophora*	*sp*	40
40	Urticaceae	*Urtica*	*dioica*	10
41	Ulmaceae	*Ulmus*	*procera*	130
42	Fagaceae	*Querus*	*robur*	330
43	Salicaceae	*Populus*	*tricocarpa*	80
44	Musaceae	*Musa*	*parasidica*	10
45	Iridaceae	*Iris*	*unguicularis*	20
46	Liliaceae	*Asparagus*	*acutifolis*	270

48	Smilacaceae	*Smilax*	*aspera*	40
49	Poaceae	*Alopecurus*	*pratensis*	440
		Zea	*mays*	2770
50	Cupressaceae	*Cupressus*	*sempevirens*	10

Table – 4. Showing the names of families, genera, species and the number of respective pollen present in the summer honey sample of Kupza village per 10 gms

Sl.No.	Family	Genera	Species	No.of pollen grains
1	Ranunculaceae	*Clematis*	*vitalba*	200
2	Papaveraceae	*Papaver*	*rhoes*	300
3	Buassicaceae	*Mathiola*	*sp*	400
4	Malvaceae	*Gossypium*	*sp*	300
5	Tiliaceae	*Tilla*	*petiolaris*	200
6	Geraniaceae	*Geranium*	*praense*	600
		Geranium	*rotundifolium*	2500
7	Aceraceae	*Acer*	*sp*	800
8	Platanaceae	*Platanus*	*orientalis*	300
9	Fabaceae	*Coronilla*	*sp*	600
		Glycine	*max*	100
		Melilotus	*alba*	500
		Sophora	*sp*	200
10	Eaesalpinaceae	*Cassia*	*didimobotrya*	700
11	Rosaceae	*Filipendula*	*ulmaria*	800
12	Myrtaceae	*Myrtus*	*communis*	200
13	Cucurbitaceae	*Cucurbita*	*pepo*	600
		Cucumis	*sativus*	700

		Citrullus	*lanatus*	400
		Diplotaxis	*erucoides*	200
14	Apiaceae	*Bupleurum*	*fruticosum*	1400
15	Cornaceae	*Cornus*	*sanguinea*	100
16	Caprifoliaceae	*Sambucus*	*nigra*	200
17	Asteraceae	*Ambrosia*	*sp*	1600
		Chrysanthemum	*sp*	2800
		Matricaria	*sp*	2000
		Michenia	*micrantha*	1200
18	Boraginaceae	*Cynoglossum*	*cueticum*	700
19	Loranthaceae	*Loranthus*	*europaeus*	100
20	Santalacene	*Thesium*	*humile*	200
21	Carylaceae	*Carylus*	*avellana*	1200
		Carpinus	*betulus*	500
22	Fagaceae	*Facus*	*sylvatica*	1100
23	Salicaceae	*Populus*	*tricocarpa*	1100
24	Musaceae	*Musa*	*paradisiaca*	200
25	Amaryllidaceae	*Galanthus*	*nivalis*	100
26	Poaceae	*Zea*	*mays*	400

Table – 5. Showing the names of families, genera, species and the number of respective pollen present in the summer honey sample of Ungma village per 10 gms

Sl.No.	Family	Genera	Species	No.of pollen grains
1	Magnoliaceae	*Liriodendron*	*tulipifera*	600
2	Papaveraceae	*Papaver*	*rhoes*	1200
3	Brassicaceae	*Brassica*	*napus*	1100
4	Malvaceae	*Abutilon*	*theophrasti*	300
		Hibiscus	*rosa – sinensis*	250
		Gossypium	*sp*	
5	Geraniaceae	*Geraniom*	*rotundifolium*	900
6	Hippocastanaceae	*Aesculus*	*hippocastanum*	1500
7	Aceraceae	*Acer*	*sp*	800
8	Anacardiaceae	*Cotinus*	*sp*	500
9	Tabaceae	*Ceratonia*	*coccineus*	900
		Phaseolus	*pseudacacia*	300
		Robinia	*siliqua*	400
10	Rosaceae	*Eriobotrya*	*japonica*	700
		Filipendula	*ulmaria*	600
11	Myrtaceae	*Eucalyptus*	*gunii*	200
12	Cucurbitaceae	*Cucumis*	*sativus*	400
13	Apiaceae	*Bupleurum*	*fruticosum*	2500
14	Asteraceae	*Artemisia*	*vulgaris*	1000
		Chrysanthemum	*sp*	3500
		Helianthus	*annuus*	3100
		Michenia	*micrantha*	1400
15	Boraginaceae	*Cynoglossum*	*reticum*	5400

16	Serophulariaceae	*Antirrhinum*	*majus*	300
17	Polygonaceae	*Fagopyrum*	*esculentum*	1900
18	Euphorbiaceae	*Mercurialis*	*sp*	200
19	Urticaceae	*Urtica*	*dioica*	800
20	Juglandaceae	*Juglans*	*sp*	400
21	Salicaceae	*Populus*	*triandra*	
		Salix	*tricocarpa*	1900
22	Typhaceae	*Typha*	*angustifolia*	600
23	Musaceae	*Musa*	*paradisiaca*	500
24	Iridaceae	*Crocosmia*	*sp*	1100
25	Liliaceae	*Allium*	*sphaerocephalum*	500

Table – 6. Showing the names of families, genera, species and the number of respective pollen present in the summer honey sample of Khensa village per 10 gms

Sl.No.	Family	Genera	Species	No.of pollen grains
1	Ranunculaceae	*Ranunculus*	*bulosus*	800
2	Brassicaceae	*Diplotaxis*	*erocoides*	20
3	Malvaceae	*Habiscus*	*rosa-sinensis*	2400
4	Tiliaceae	*Tilla*	*petiolaris*	500
5	Geraniaceae	*Geranium*	*rotundifolium*	2300
6	Hippocastanaceae	*Aesculus*	*hippocastanum*	300
7	Platanaceae	*Platanus*	*orientalis*	700
8	Fabaceae	*Glycine*	*max*	100
		Phaseolus	*coccineus*	600
		Robinia	*pseudacacia*	300

9	Caesalipendula	*Cassia*	*didimobotrya*	200
10	Rosaceae	*Filipendula*	*ulmaria*	700
11	Myrtaceae	*Eucalyptus*	*gunii*	100
12	Cucubitaceae	*Cucumis*	*sativus*	300
13	Apiaceae	*Bupleurum*	*fruticosum*	400
14	Asteraceae	*Chrysanthemum*	*sp*	400
15	Polygonaceae	*Fagopyrum*	*esculentum*	600
16	Santalaceae	*Thesium*	*humile*	800
17	Euphorbiaceae	*Mercurialis*	*perennis*	100
18	Corylaceae	*Corylus*	*avellena*	700
19	Fagaceae	*Facus*	*sylvatica*	300
20	Typhaceae	*Thypha*	*angustifolia*	200
21	Musaceae	*Musa*	*paradisiaca*	100
22	Iridaceae	*Iris*	*pseudoacorus*	400
23	Liliaceae	*Allium*	*sphaerocephalum*	2600
24	Poaceae	*Alopecurus*	*pratensis*	200
		Zea	*mays*	100

Table – 7. Showing the names of families, genera, species and the number of respective pollen present in the summer honey sample of market per 10 gms

Sl.No.	Family	Genera	Species	No.of pollen grains
1	Brassicaceae	*Brassica*	*napus*	100
2	Capparidaceae	*Capparis*	*spinosa*	300
3	Violaceae	*Viola*	*tricolour*	200
4	Balsaminaceae	*Impatiens*	*glandulifera*	100
5	Meliaceae	*Melia*	*azedarach*	100
6	Fabaceae	*Glycine*	*max*	100

		Melilotus	*albameticus*	300
		Ononis	*pubescens*	100
		Trifolium	*pratense*	300
7	Rosaceae	*Prunus*	*domestica*	100
8	Cucurbitaceae	*Cucumis*	*sativus*	100
9	Apiaceae	*Bupleurum*	*fruticosum*	700
10	Boraginaceae	*Alkanna*	*tinctoria*	100
		Echium	*italicum*	200
11	Convolvulaceae	*Convolvulus*	*cantabrica*	200
12	Lauraceae	*Laurus*	*nobilis*	200
13	Fagaceae	*Castanea*	*sativa*	800
14	Liliaceae	*Aspauagus*	*acutifolius*	100

SUMMARY

SUMMARY

Qualitative analysis of honey samples

(Table – 1 – 10)

Winter Sample

As shown in table – 1, Honey samples collected from three villages of the Mokokchung district in Nagaland state exhibit that in Khensa village the winter honey contains pollen grains of 86 genera belonging to 44 families of dicots angiosperms, 5 families of monocots angiosperms and one family of conifers (gymnosperms). Whereas, Kubza village winter honey sample shows pollen grains of 85 genera belonging to 45 families of dicot angiosperms, 5 damilies of monocot angiosperms and two families of conifers (gymnosperms). But the Ungma village shows the maximum number of genera i.e., 101 genera belonging to 49 families of dicot angiosperms, one family of monocot angiosperms and one family of conifers (gymnosperms).

Summer Samples

As shown in table – 2, the honey samples collected from Khensa village during summer season i.e., August – September shows pollen grains of 27 genera belonging to 19 families of dicot angiosperms and 5 families of monocot angiosperms but gymnosperms pollen grains were absent. Whereas, Kubza village honey samples exhibit pollen grains of 37 genera belonging to 23 families of dicot angiosperms and 3 families of monocot angiosperms. The gymnospermous are absent in Kubza sample too. The honey samples collected from Ungma village during August And September reveal that the pollen grains of 34 genera belonging to 21 families of dicot angiosperms and 4 families of monocot angiosperms are present. In the summer sample of Ungma village also pollen grains of conifer families (gymnospermspollen are absent).

Table – 8. Showing the number of genera and families whose pollens are present in winter honey sample of investigated localities during 2002 – 2004.

Sl.	Name of locality	No. of genera		No. of families		No. of genera	No. of families
		Monocot	dicot	Monocot	dicot	Gymnosperm	Gymnosperm
1.	Khensa village	5	76	5	44	1	1
2.	Kubza village	6	77	5	45	2	2
3.	Ungma village	4	96	2	49	1	1

Table – 9. Showing the number of genera and families whose pollens are present in summer honey sample of investigated localities during 2002 – 2004.

Sl. no.	Name of locality	No. of genera		No. of families		No. of genera	No. of families
		Monocot	dicot	Monocot	dicot	Gymnosperm	Gymnosperm
1.	Khensa village	6	21	5	19	-	-
2.	Kubza village	3	34	3	23	-	-
3.	Ungma village	4	30	4	21	-	-

Quantitative analysis of honey samples

Winter honey samples

The quantitative analysis shows the presence of total number of 44620 pollen/10 gm of honey, collected during winter season in Khensa village. Out of these 40940 pollens belong to dicot angiospermous taxa, 3670 belong to monocot angiospermous taxa, whereas, only 10 pollens belong to gymnospermous taxa.

The winter honey sample of Kubza village exhibit the presence of 31013 pollen grains, out of which 660 belongs to monocots angiospermous taxa, 30323 belongs to dicot angospermous taxa and 30 pollen belongs to gymnospermous (conifers) taxa per 10 gm of honey.

The winter honey samples collected from Ungma village exhibit a total number 60420 pollen per 10 gm of honey, out of which 57280 belong to dicot angiospermous taxa, 3130 pollen belong to monocot angiospermous taxa and only 10 pollen grains belong to gymnospermous taxa.

Summer honey samples

The quantitative analysis of honey sample collected summer season (August – September, 2002 – 2004) from Khensa village exhibit a total number of 16400 pollens per 10 gm. Out of these 12800 belong to dicot angiospermous taxa, 3600 monocot angiospermous taxa and no pollen of gymnospermous taxa.

The summer honey sample collected from Kubza village shows the presence of 25700 pollen per 10 gm. Out of which 2500 belongs to dicot angiospermous taxa, 700 monocot angiospermous taxa and no pollen of gymnospermous taxa.

The quantitative analysis of honey samples collected from Ungma village exhibit a total number 37500 pollens per 10 gm. Out of which 34900 pollens belong to dicot angiospermous taxa, 2600 pollen to monocot angiospermous taxa but gymnospermous pollen were absent.

Table – 10. Showing the number of pollen grains per 10 gm of honey sample collected during winter and summer from various localities of investigation during the year 2002 – 2003 and 2003 – 2004.

Sl. no	Name of locality	WINTER SAMPLE			Total number of taxa	SUMMER SAMPLE			Total number of taxa
		No. of pollen belonging to Dicot angiospermous taxa	No. of pollen belonging to monocot angiospermous taxa	No. of pollen belonging to gymnospermous taxa		No. of pollen belonging to Dicot angiospermous taxa	No. of pollen belonging to monocot angiospermous taxa	No. of pollen belonging to gymnospermous taxa	
1.	Khensa Village	40940	3670	10	44620	12800	3600	Nil	16400
2.	Kubza Village	30323	660	30	31013	25000	700	Nil	25700
3.	Ungma village	57280	3130	10	60420	34900	2600	Nil	37500

Market sample

Qualitative analysis of market honey sample

Qualitative melissopalynological analysis of market honey samples collected from Mokokchung daily market exhibit pollens of 18 genera belonging 13 families of dicot angiosperms. However, the gymnosperms pollen grains were absent in market honey samples.

Quantitative analysis of market honey sample

Quantitative melissopalynological analysis of market honey sample collected from the Mokokchung daily market reveals the presence of 4000 pollen grains per 10 gm of honey. Out of which 3900 pollen belong to dicot angiospermous taxa and only 100 pollen grains belong to a single family viz., Liliaceae and single genus *Asparagus.*

Poisonous/Allergic pollen grains in various honey samples

Repeated observation of winter and summer honey samples of various localities reveal the presence of few allergic pollens, viz., *Xanthium*, *Strumarium,Alnus glutinosa, Betula pendula, Artamisia sp.* And others. These pollen grains when eaten by the cattles in bulk along with the respective plants, causes poisoning in them (www.allergenica.com/greer. asp; www.labspec.co.za/1_ weed. htm).

RESULTS

AND

DISCUSSION

Results and Discussion

Melissopalynological investigaton of three localities,viz., Khensa village, Ungma village and Kubza village of Mokokchung district during the winter months (January – February) and summer months (August – September) for two years i.e., 2002 -2003 and 2003 – 2004 reveal that the honey samples collected during winter season contain maximum number of pollen contents. The number of pollen ranges from minimum 31013 pollens per 10 gm in Kubza village honey followed by Khensa village honey samples i.e., 44620 pollen per 10 gm and the maximum number of pollen i.e., 60420 pollen per 10 gm was found in the Ungma village honey samples. Whereas, summer samples of honey in all the three localities exhibit rather low frequency of pollen grains.E.g., summer honey samples from Khensa village shows minimum number of pollen grains i.e., 16400 per 10gm, but the summer honey samples from Kubza village shows 25700 pollens per 10 gm. Whereas, the honey samples from Ungma village shows 37500 pollens per 10 gm. of honey which is the maximum number of pollens present per 10 gm in the investigated samples.

Therefore, on the basis of present investigation and the results, it can be concluded that out of three localities (Khensa, Kubza and Ungma), the Ungma village and its surroundings possesses maximum diversity of plants which contribute as pollen flora (table - 9) to the honey bees of this locality. These results are also found correct by qualitative analysis of honey samples of these localities. According to the qualitative analysis of winter samples of honey from these three localities it is evident that in Ungma village pollen contributot taxa belongs to 100 genera of 52 families. Out of this 96 genera belongs to the 49 families of dicot angiosperms (table – 7).

However, the contributor plants are rather less in number e.g., Ungma village summer honey sample exhibit 34 genera belonging to 25 families of angiospermous taxa but the pollen grains of gymnospermous taxa are absent. Out of these, the number of dicot families and genera is much more in comparision to monocot. i.e., 30 genera belonging to 21 families of dicot angiospermous. Whereas only 4 genera of 4 families of monocot angiospermous are there.

The maximum number of families and genera contributing the pollen flora in summer honey sample was recorded in Khensa village i.e., 26 genera belonging to 24 families of angiospemous. Out of these 19 families with 21 genera of dicots and 5 families with 6 genera of monocot represent the pollen flora. In summer sample not even a single pollen grain of gymnospermous taxa has been observed (table – 7).

On the basis of these qualitative and quantitative analysis, it is concluded that the maximum number of pollen grains in the honey in Mokokchung district during winter as well as summer comes from the taxa belonging to dicotyledonous angiosperms and the number of pollen from monocotyledonous angiosperms is rather less. The presence of pollen grains of gymnospermous taxa is very less and hence can be considered as contamination because during January – February the pollen grains of *Pinus sylvestris* and *Cupressus sp* are very frequent in the air. The presence of a few fungal spores and hyphae in honey sample is also found as contamination.

Comparison of results with that of the Market samples

The seasonal (winter and summer) qualitative and quantitative analysis of honey samples collected from Khensa, Kubza and Ungma villages of Mokokchung district shows a high frequency of pollen grains I.e., ranging from – 31013 to 60420 per 10 gm in summer samples with a wide range of families (50 – 52) and genera (82 – 101) belonging to angiosperms as well as gymnosperms. But the qualitative and quantitative analysis of market sample exhibit pollen flora belonging only 17 genera of 13 dicot families and 1 genus of one monocot family. However, the pollen grains of gymnospermous plant are not present in market sample. The total number of pollen grains in market sample in comparison to that of natural bee hive samples from investigated localities, also under represented i.e., only 4000 pollen grains per 10 gm of honey. These comparison of pollen frequency per 10 gm of honey sample between natural honey sample collected by bees and market sample, clearly indicate adulteration of market honey in Mokokchung town.

Colour of the honey

In the light of present investigation (quantitative as well as qualitative) it has been concluded that the colour of winter honey is always dark brown and the summer honey is always light brown. This may be interpreted as due to the presence of pollen grains during winter and lesser number i.e., almost half of the number of that of the winter sample. But when examine the market honey colour, it is always dark brown, whereas, the number of pollen grains per 10 gm is nearly 12 to 15 times lesser than winter honey sample. These result also indicate that market samples are not pure.

Unifloral and multifloral honey

Winter sample honey of Khensa and Ungma villages exclusively shows the presence of Asteraceae pollen grains as maximum e.g., Khensa village shows 50.87%, Kubza shows 70.06% and Ungma shows 49.04%. Therefore, the winter honey can be termed as Asteraceous honey (here the single floral honey can not be given the name), whereas, the summer honey cannot be categorized in any category as the presence of pollen grains in Ungma sample in Asteraceous 24% as maximum. The Kubza sample exhibit Asteraceous pollen 29.57% which is maximum and Khensa sample shows Malvaceous pollen 14.63% followed by Geranceaceous pollen 14.02% and Liliaceous pollen as 15.85%. Hence, the summer honey samples of all the three villages may be categorized as multifloralhoney.

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PHOTOMICROGRAPH

PLATES

Plate – 1

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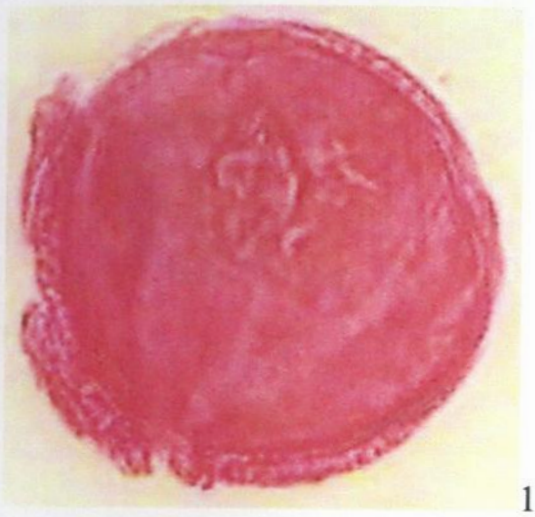

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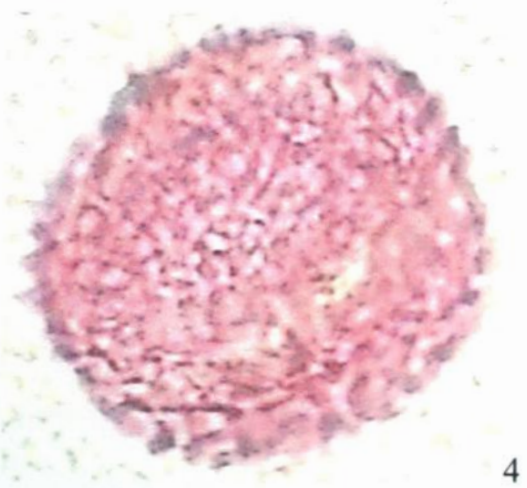

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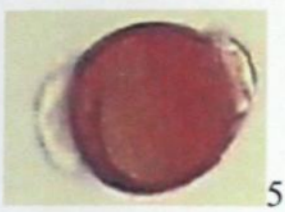
FIG: 1- *Helleborus niger* 2- *Clematia vitalba*

3-Liriodendron tulipefira *4-Magnolia grandiflora*

Plate – 2



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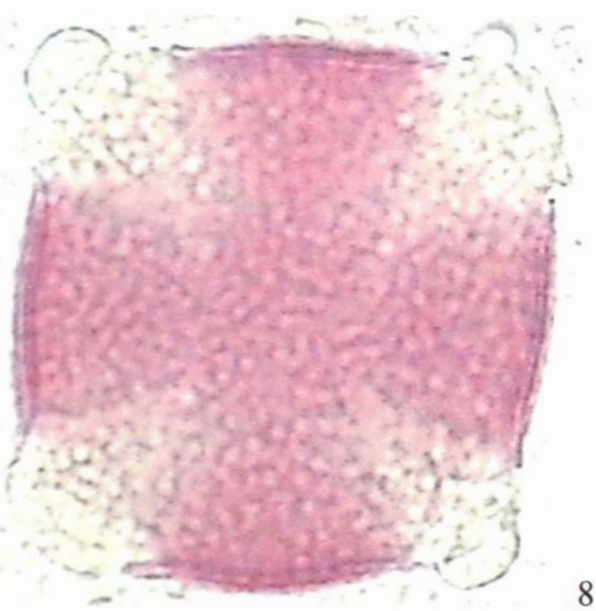

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FIG:5- *Hypecoum procumben* 6 - *Brassica napus*

7- *Cardamine pratensis* 8- *Viola tricolor*

Plate – 3

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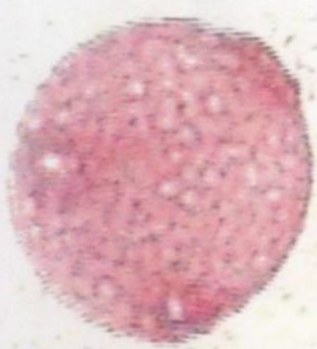

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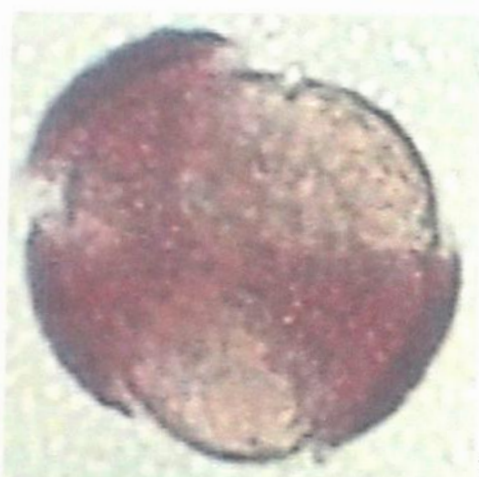

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FIG: 9- *Lychnis flos-cuculi* *10- Spercularia rupina*

11- *Stellaria media* *12- Tamarix gallica*

Plate - 4

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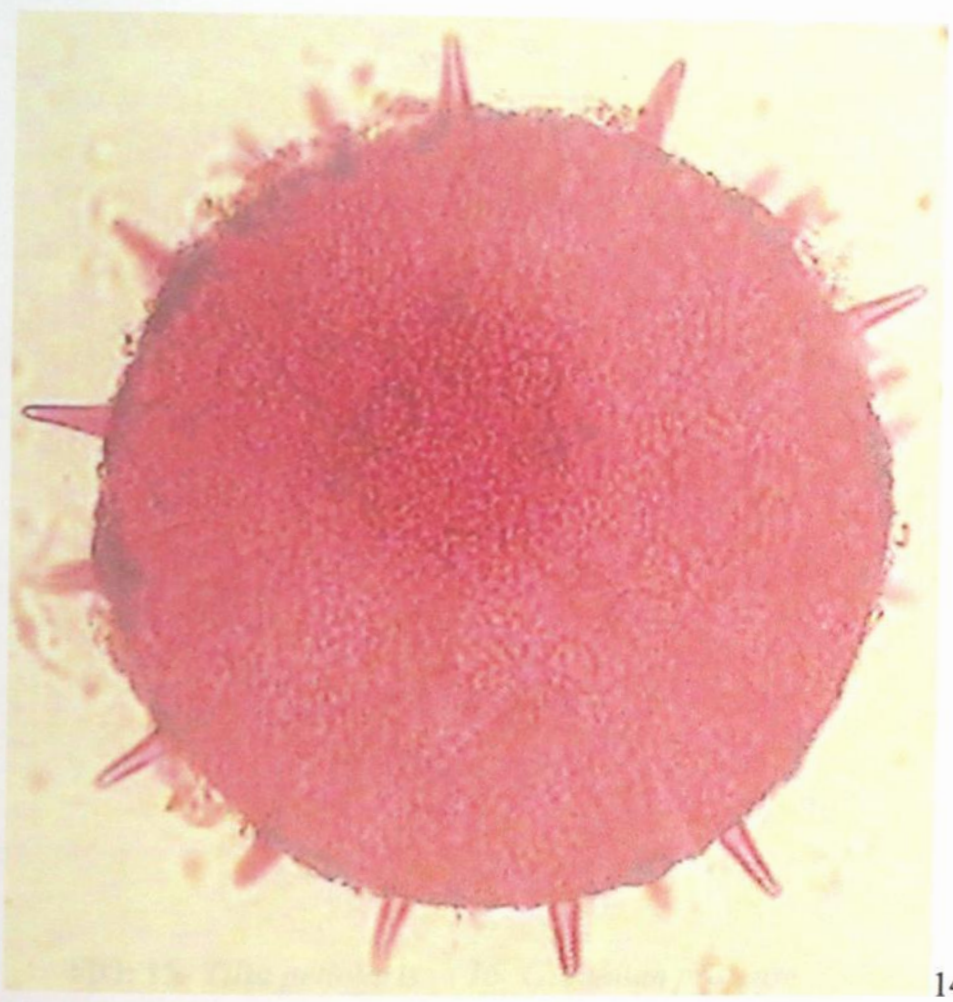

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FIG: 13- *Helianthemum chamaecistus* *14-Hibiscus rosa-sinensis*

Plate - 5

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FIG: 15- *Tilia petiolaris* *16- Geranium pratense*

Plate – 6

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FIG: 17- *Geranium rotundifolium* *18- Oxalis articulata*

Plate - 7

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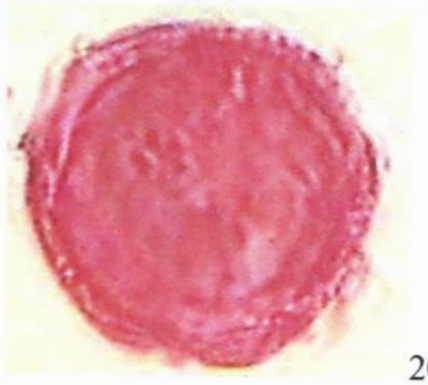

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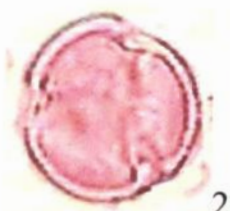

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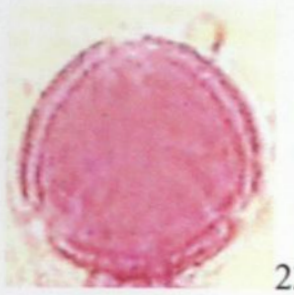
FIG: 19- *Impatiens glandulifera* *20- Citrus limon*

21- *Parthenocissus tricuspidata* *22- Vitis vinifera*

Plate - 8



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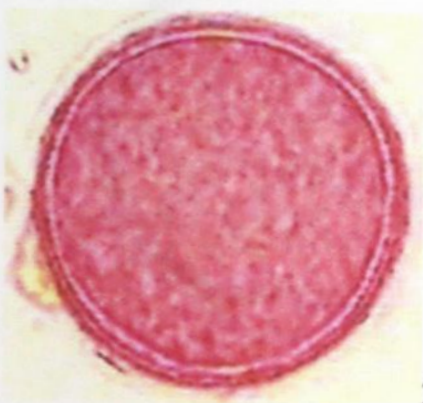

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FIG: 23-*Aesculus hippocastanum* *24- Acer pseudoplatanus*

25- Pistacia lentiscus *26- Platanus orientalis*

Plate -9

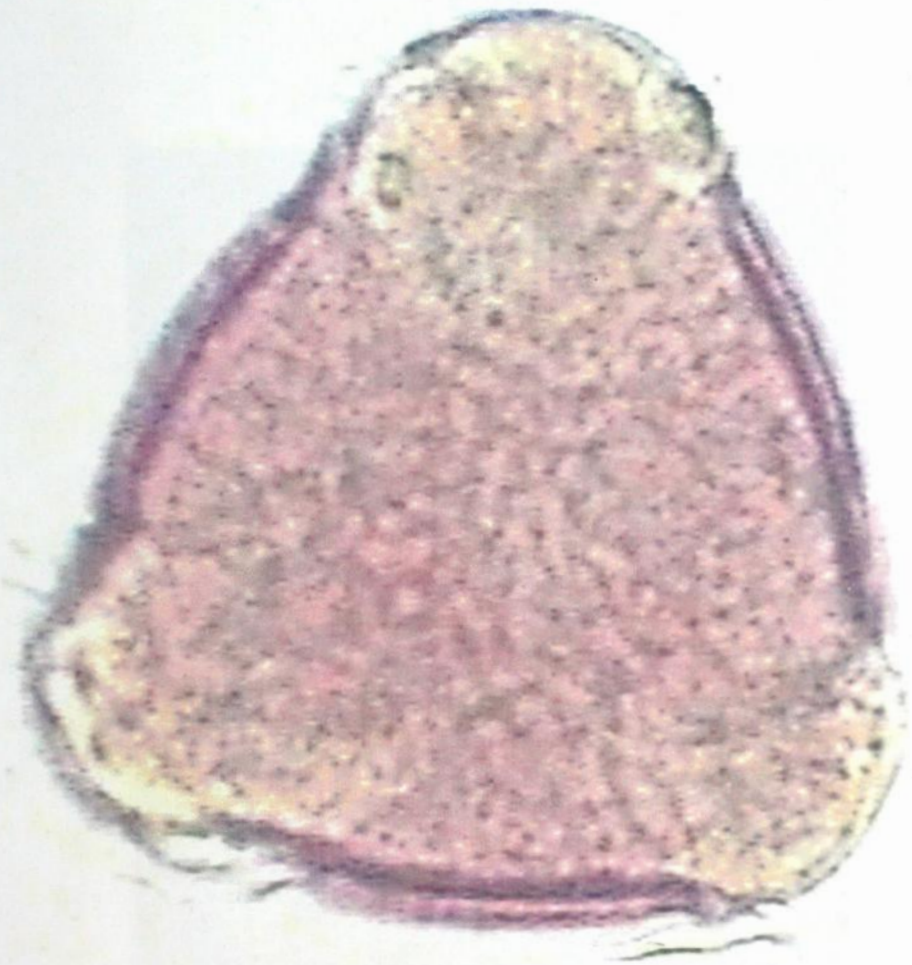

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FIG: *27- Coronilla emerus*

Plate - 10

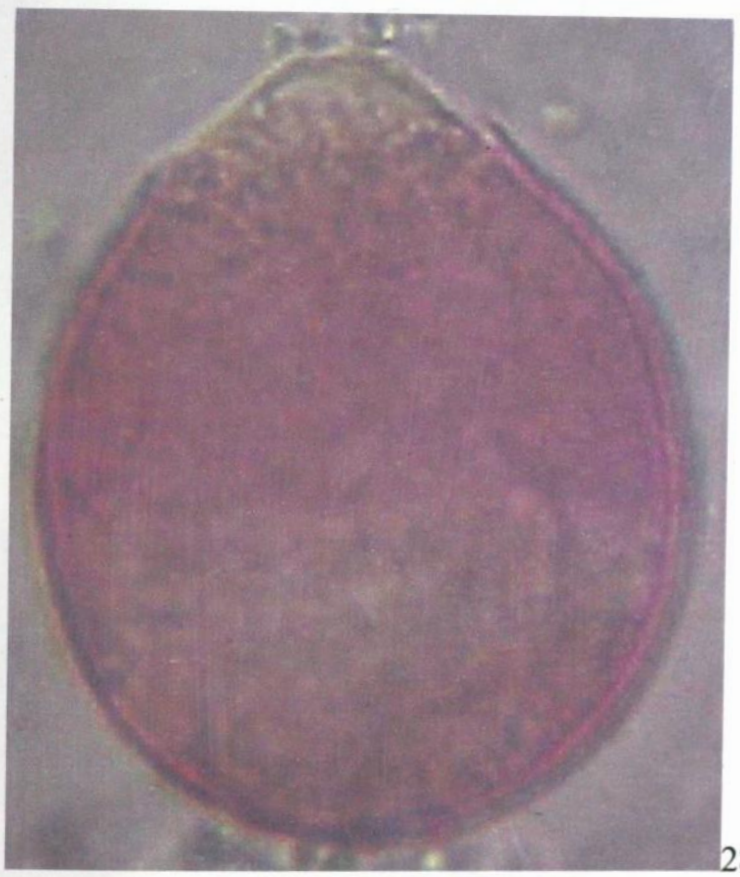
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FIG: 28- Calycotome spinosa

Plate – 11

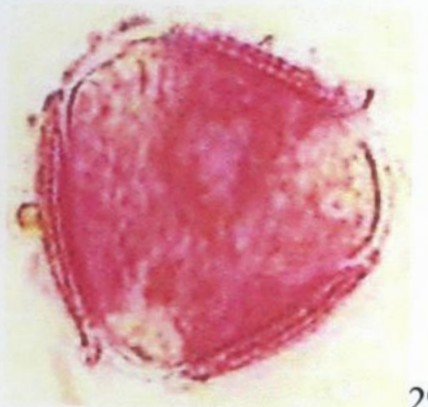

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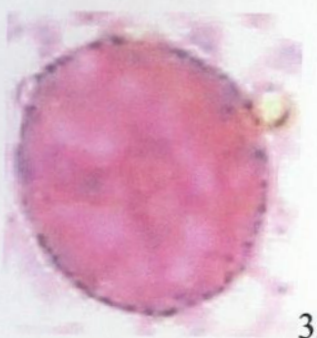
FIG: 29- *Gleditsa triancanthos* *30- Glycine max*

31- *Lupinus albus* *32- Medicago sativa*

Plate - 12



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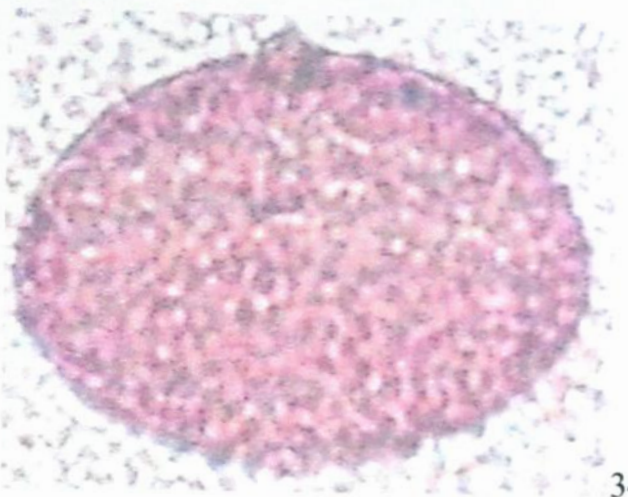

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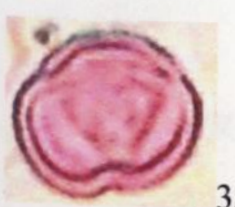

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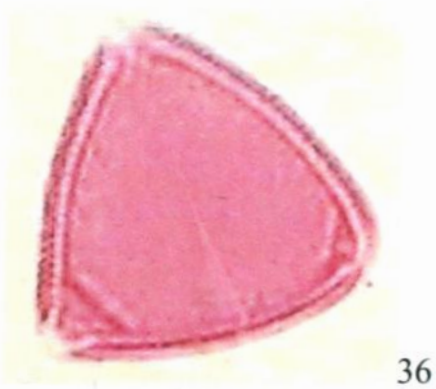

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FIG: 33- *Melilotus alba*

34- Onobrychis vicifolia

35- *Ononis pubescens*

36- Robinia pseudoacacia

Plate – 13

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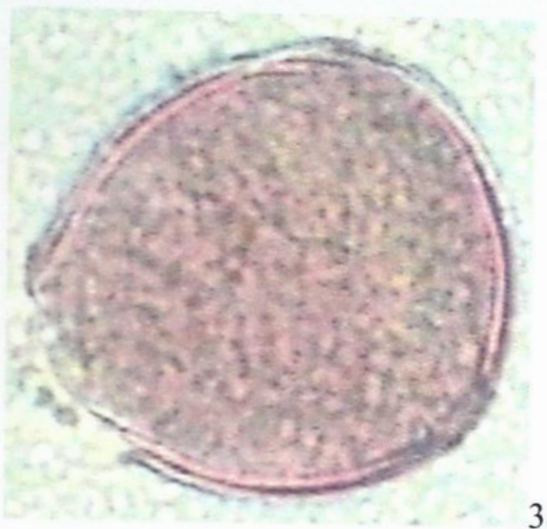

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FIG:37- *Sophora japonica* 38- *Ulex galli*

39- *Vicia faba* 40- *Cassia didibotrya*

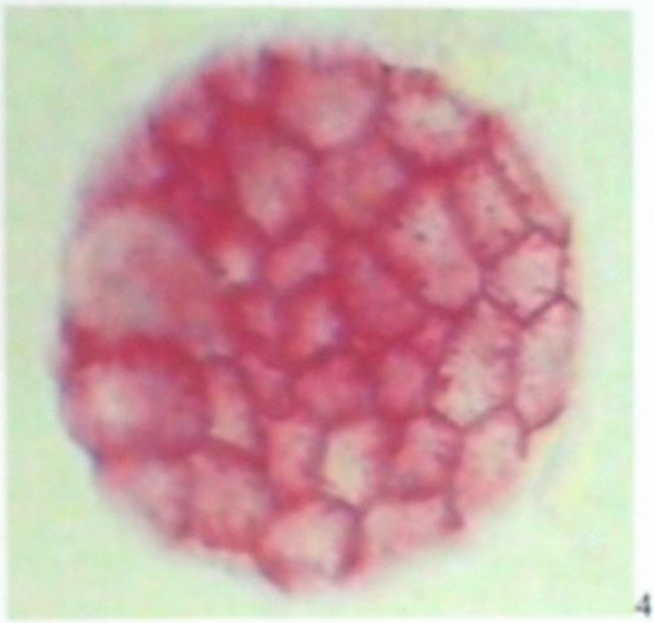

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FIG:41- *Acacia dealbata* 42- *Crataegus monogyna*

Plate - 15

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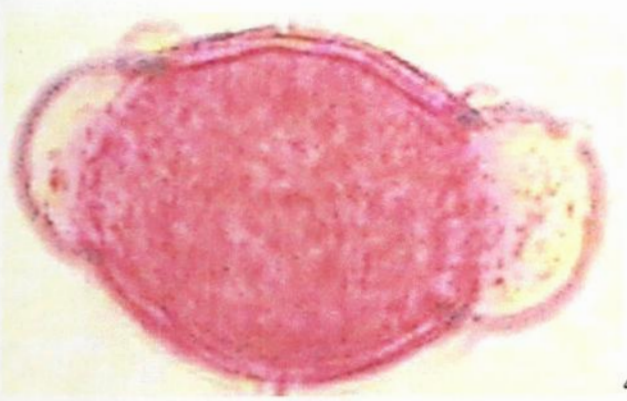

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FIG: 43- 44- *Malus domestica*

Plate - 16

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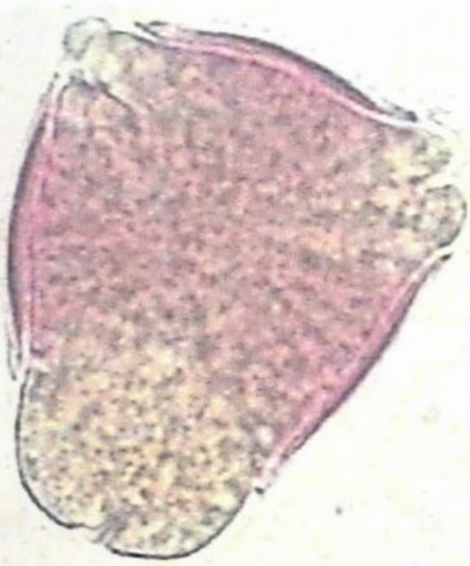

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FIG: 45- *Prunus dulcis* *46- Pyrus communis*

Plate -17

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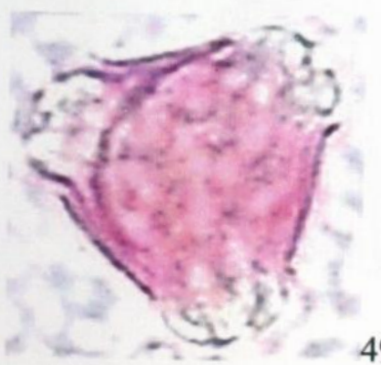

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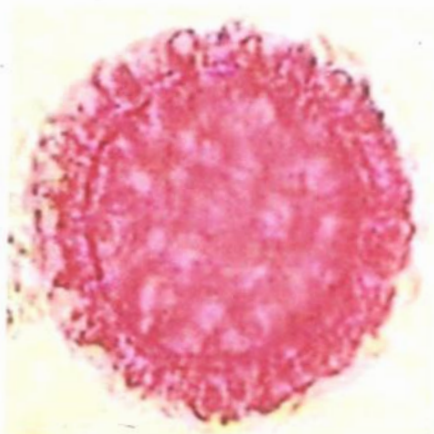

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FIG: 47- *Sedum acre* 48- *Eucalyptus gunni*

49- Myrtus communis *50- Passiflora edulis*

Plate - 18

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FIG: *51- Bryonia dioica* 52- *Citrullus lanatus*

Plate – 19

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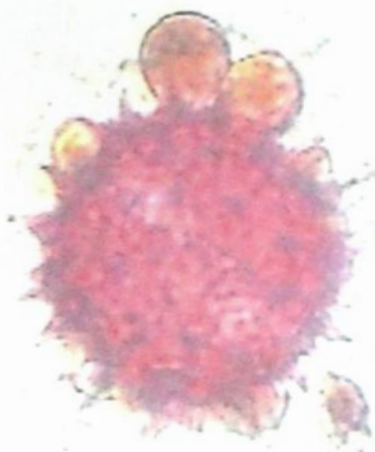

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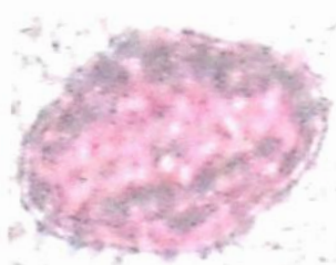

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FIG: 53 -*Ecballium elaterium* 54- *Cucubita pepo*

55- *Bupleurum fruticosum* *56- Smyrnium olusatrum*

Plate - 20

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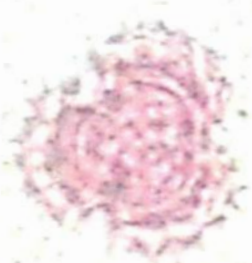

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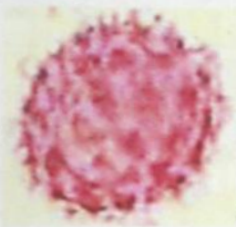
FIG: 57- *Hedera helix* *58- Cornus sanguinea*

59 - *Ageratum conizoides* *60- Arctium sp*

Plate - 21



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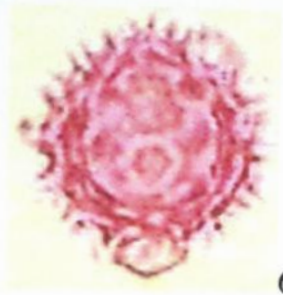

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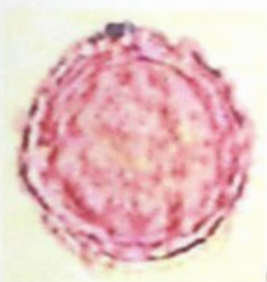

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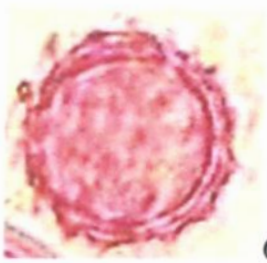
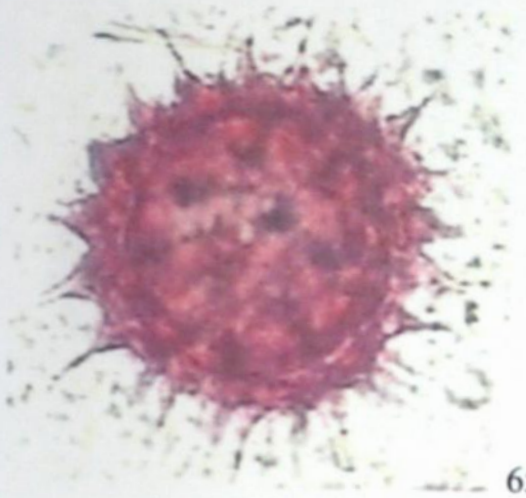


64

FIG: 61- *Aster sp* *62-Carduus sp*

63- *Carthamus sp* *64- Circium sp*

Plate - 22



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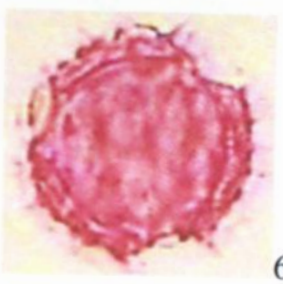

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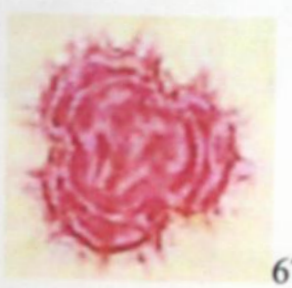

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FIG: 65- *Helianthus annuus* 66- *Inula sp*

67- *Matricaria sp* 68- *Michenia micrantha*

Plate – 23

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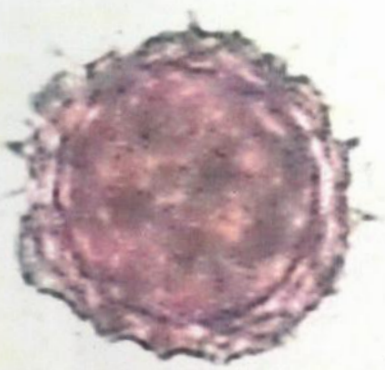

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FIG: *69- Solidago canadensis* *70- Taraxacun officinale*

71- Xanthium strumarium *72- Arbutus unedo*

Plate - 24

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FIG: 73- *Erica sp* *74- Diospyros kaki*

75- *Fraxinus excelsior* *76- Alkanna tinctoria*

Plate – 25

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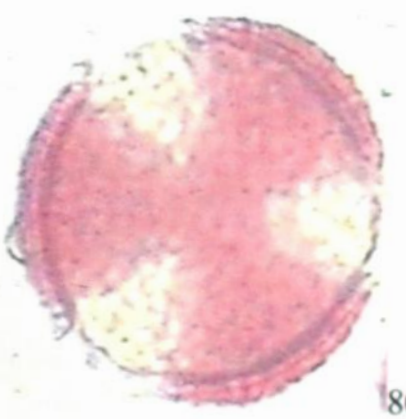

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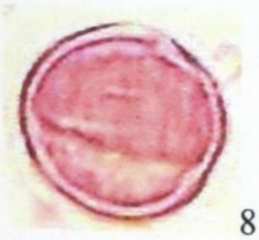
FIG: 77- *Cynoglossum craticum* *78- Echium italicum*

79-*Symphytum officinale* *80- Convolvulus cantabrica*

Plate - 26



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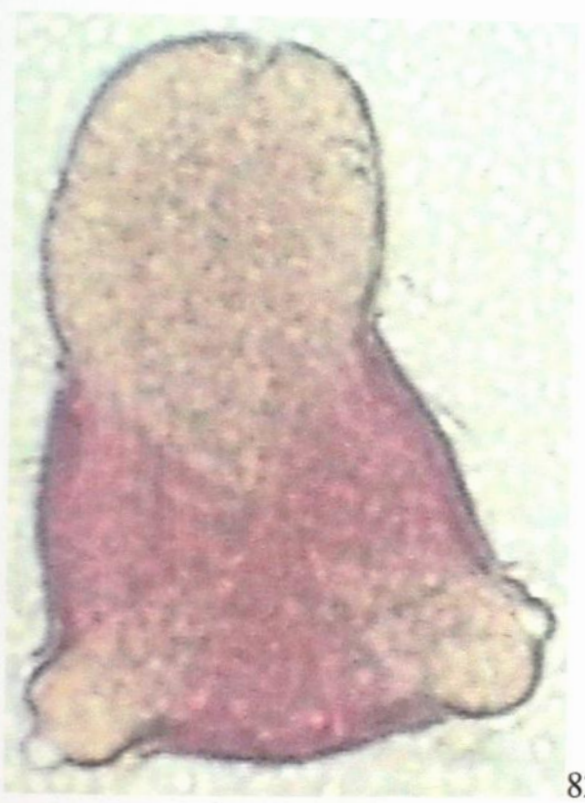
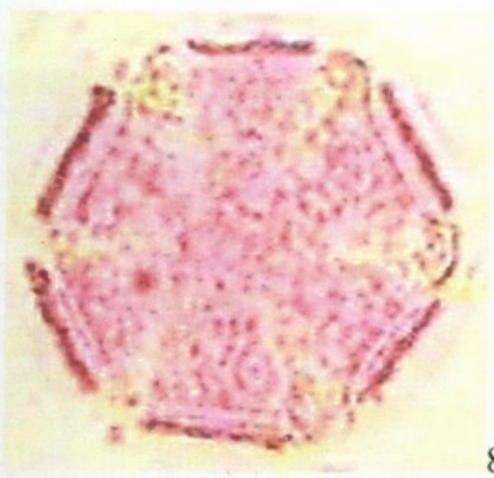


82

FIG : 81- *Antirrhinum majus* *82- Verbascum thapsus*

Plate – 27

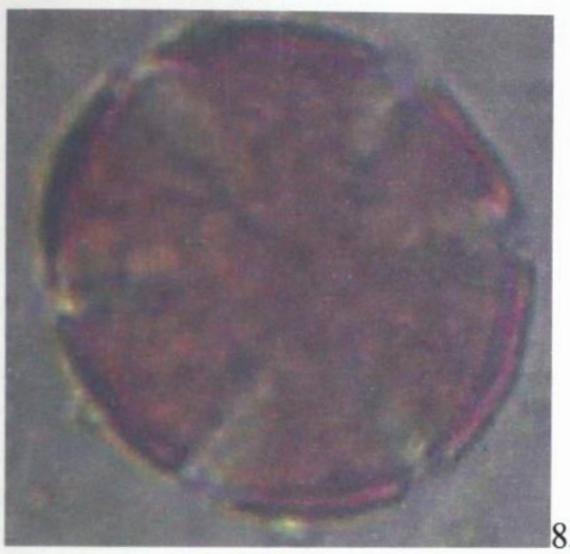
83



84

FIG : 83- *Verbena officinalis* *84 – Lavandula agustifolia*

Plate - 28



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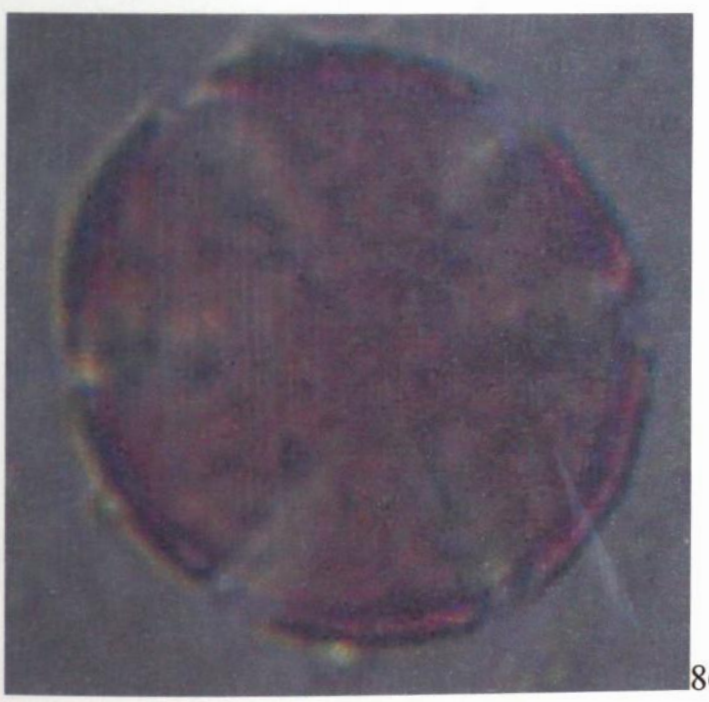
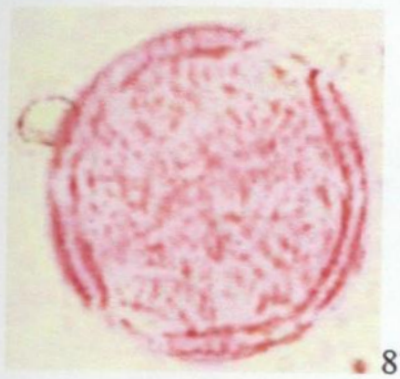


86

FIG :85 – 86 - *Mentha pulegium*

Plate - 29



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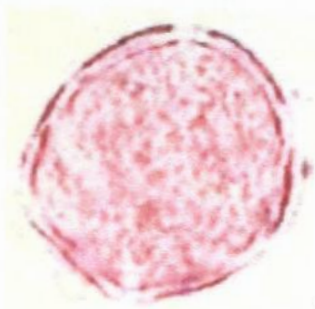

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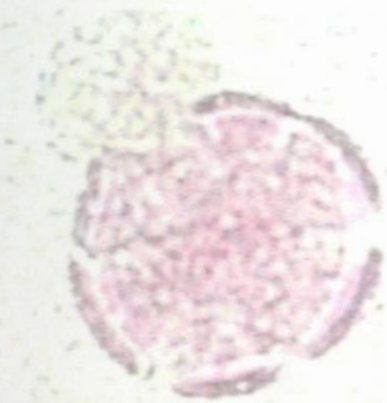

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FIG : 87- 88- *Rosmarinus sp* *89- Teucrium sp*

90- Thymus sp

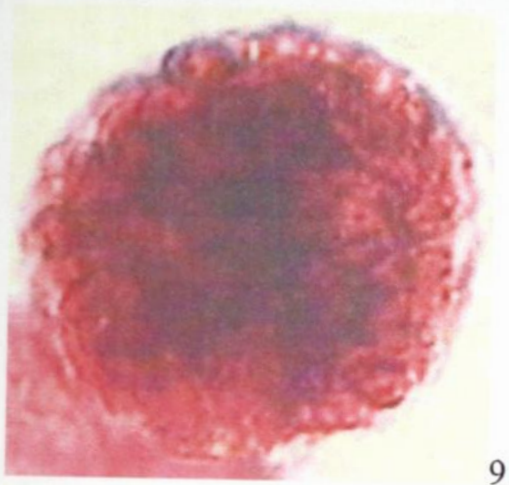

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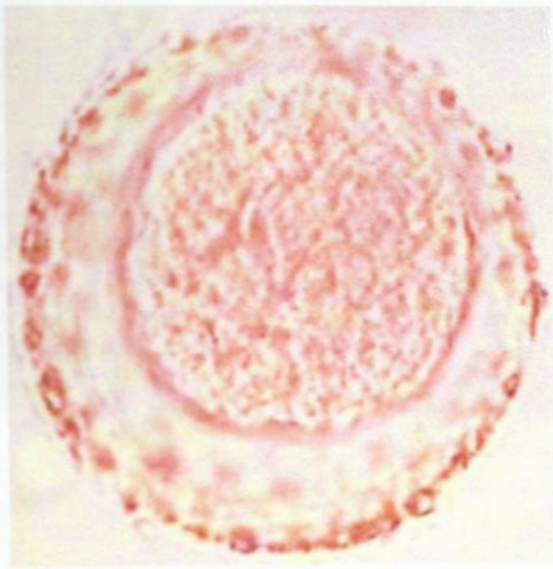
FIG : 91- *Chenopodium sp* 92- *Fagopyrum esculentum*



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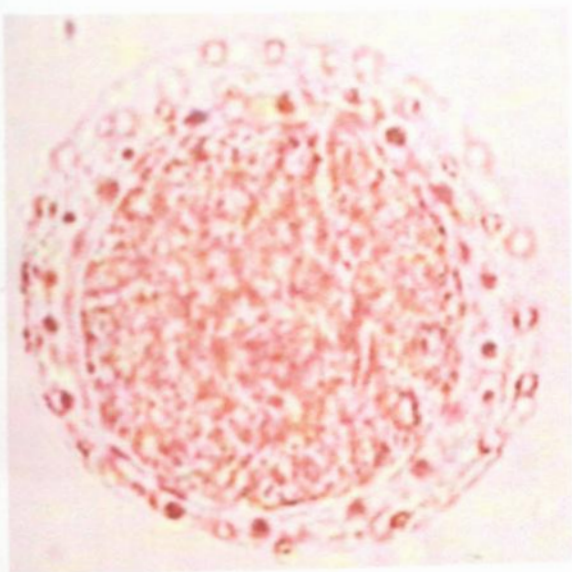

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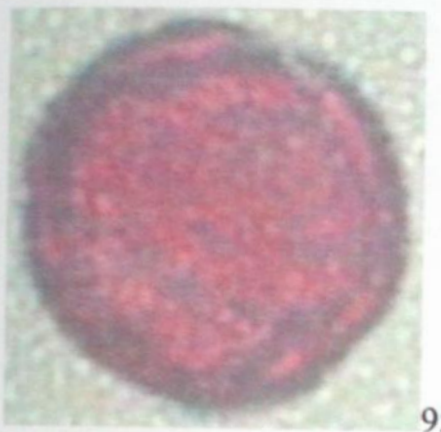
FIG : 93- 94- *Laurus nobilis*

Plate – 32



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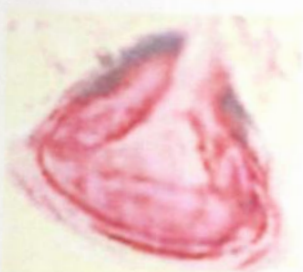

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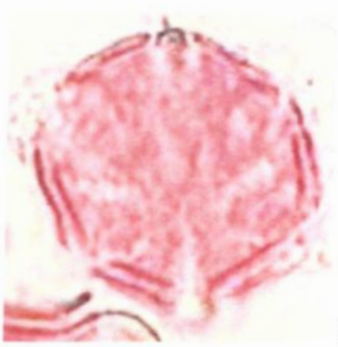

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FIG: 95- Daphne gnidium *96- Hippophae rhamnoides*

97- Loranthus sp *98- Chrozophora sp*

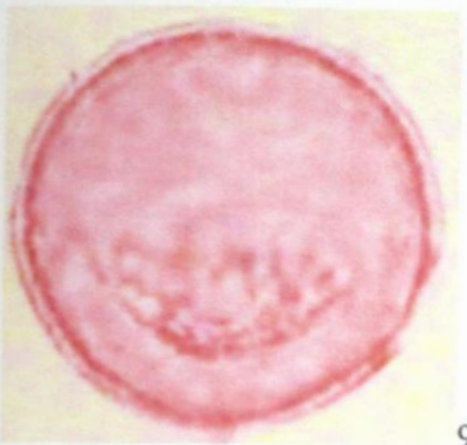

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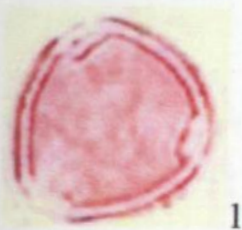
FIG:99- *Urtica dioica* *100- Ulmus procera*

101- Almus glutinosa *102 - Betula pendula*

Plate – 34



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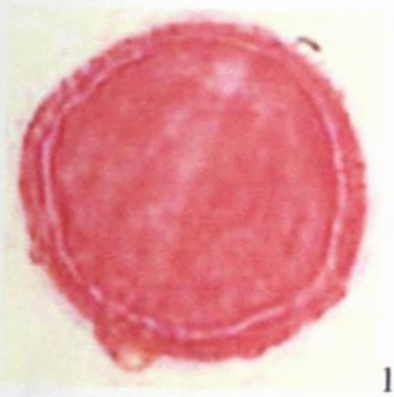

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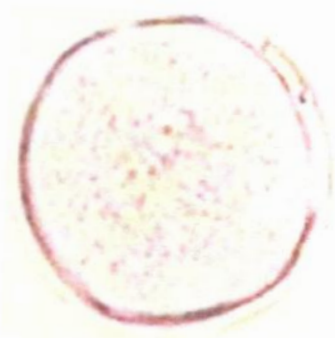

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FIG: 103- *Castanea sativa* *104- Quercus robur*

105 - Populus tricocarpa *106 - Musa x paradisiaca*

Plate - 35

107

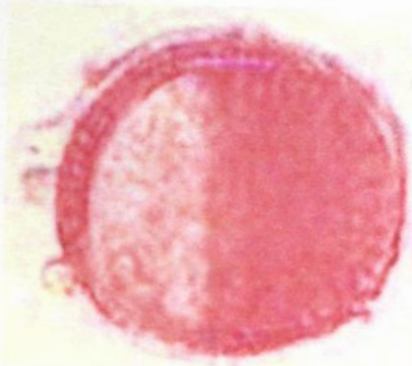

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FIG: 107- *Cronus purpurea* *108- Iris unguicularis*

109- *Allium cepa* *110- Asphodelus microcarpus*

Plate - 36

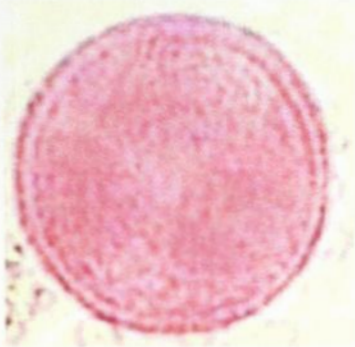

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FIG : 111 - *Alopecurus pratensis*

Plate - 37

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FIG : 112 -113- *Zea mays*

Plate - 38

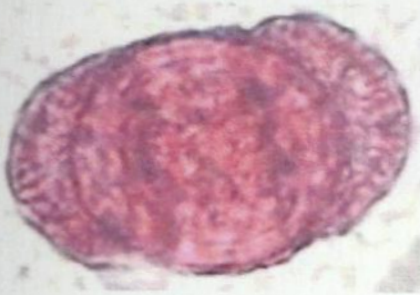

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FIG: 114 – 116 - *Pinus insularis*

Plate - 39


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FIG : 117- *Cupressus sempeviren*

Plate - 57

UMMER SAMPLE:.....

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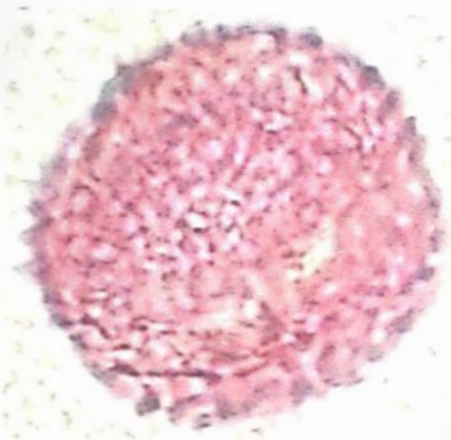

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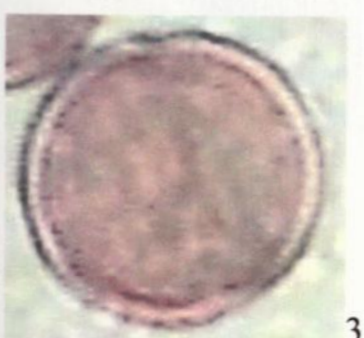

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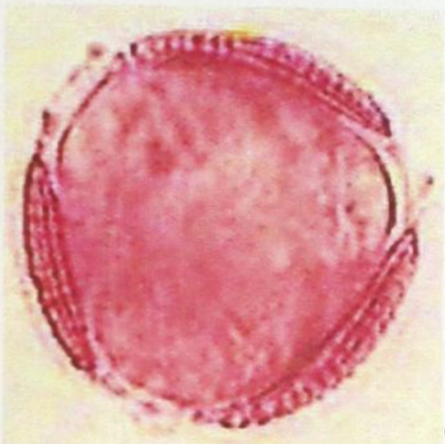
FIG: 1- *Clematis vitalba* 2- *Liriodendron tulipifera*

3- *papaver rhoes* 4- *Brassica napus*



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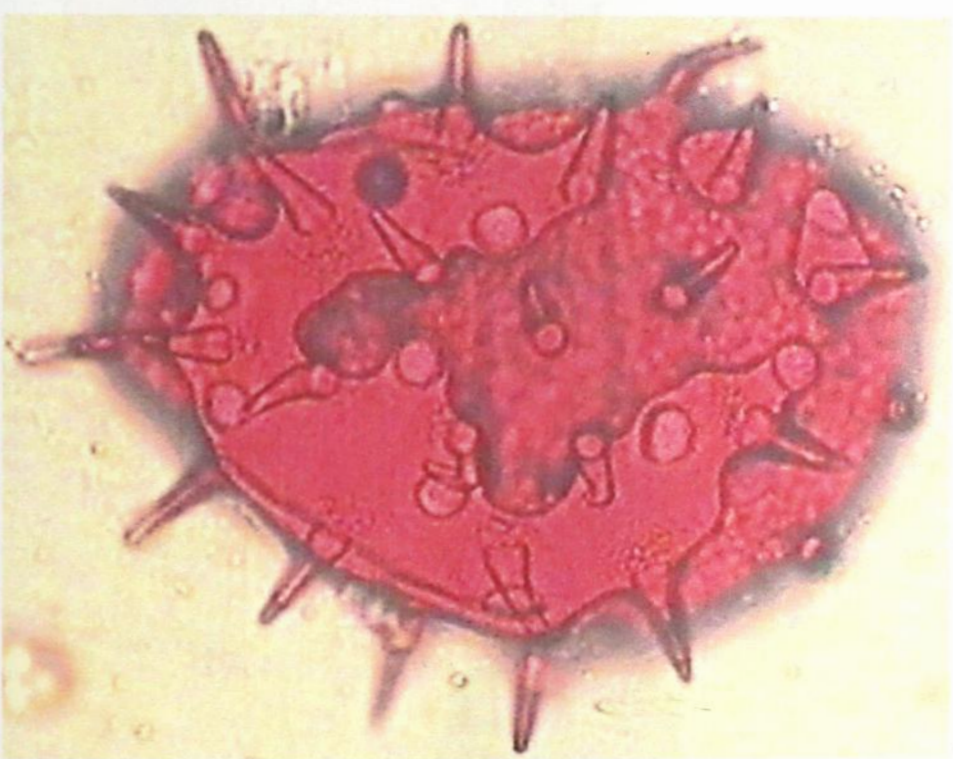

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FIG: 5- *Diplotaxis erocoides*

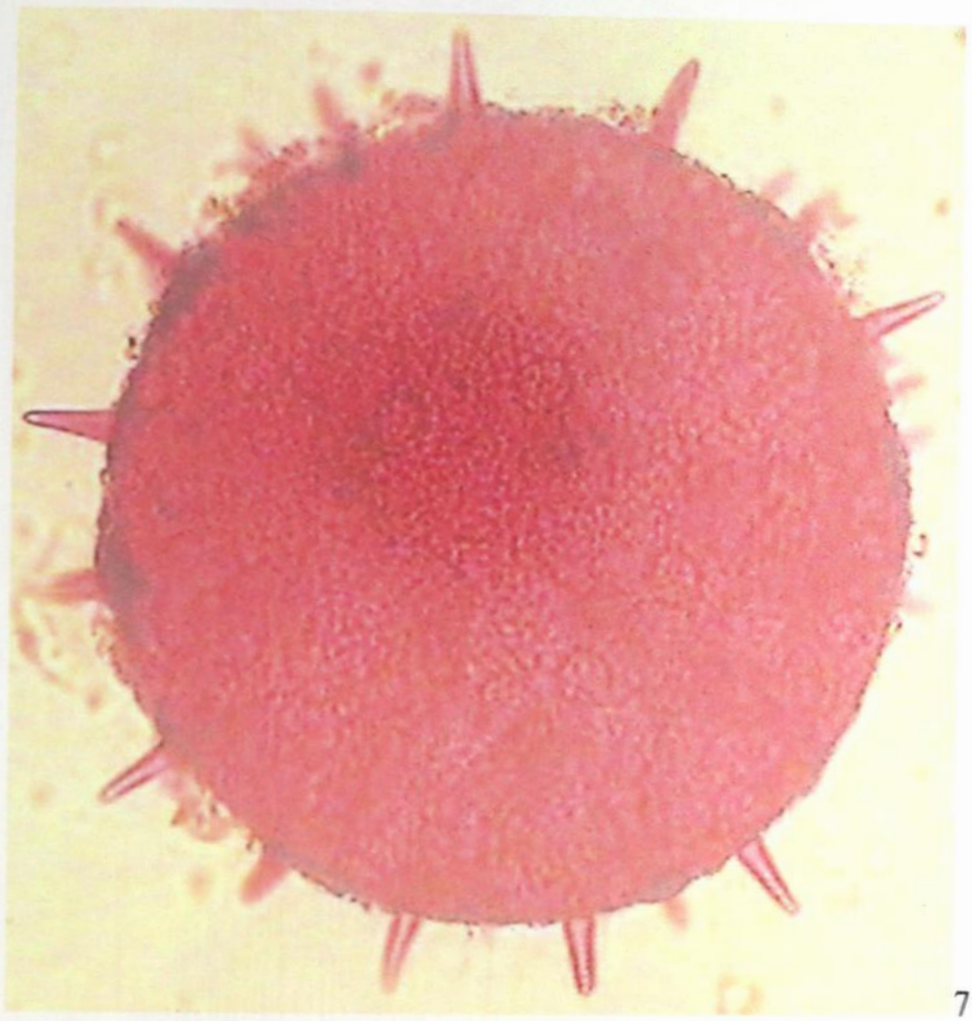

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FIG: 6 - 7- *Hibiscus rosa - sinensis* 8- *Tilia petiolaris*

Plate – 43

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FIG:9- *Geranium pratense* 10-*Geranium rotundifolium*

Plate - 44

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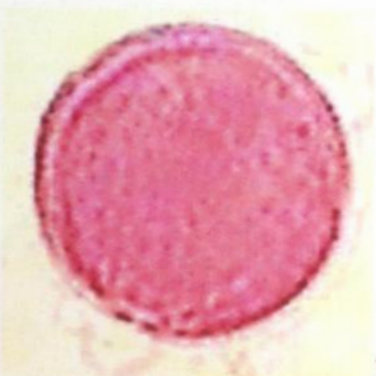

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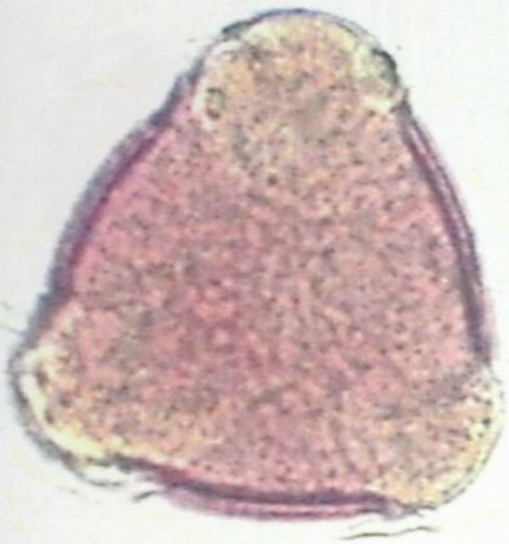
FIG: 11 *Aesculus hippocastanum* 12- *Acer sp*

13- *Cotinus sp* 14- *Platanus orientalis*

Plate – 45



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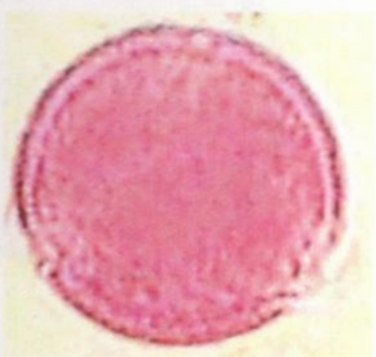

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FIG: 15 - *Coronilla sp* 16 - *Glycine max*

17- *Phaseolus coccineus* 18- *Robinia pseudoacacia*

Plate - 46

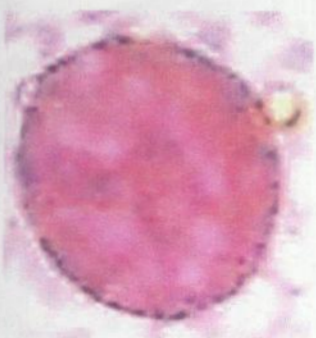

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FIG:19- *Melilotus alba*

20- *Sophora japonica*

21- *Cassia didibotrya*

22- *Filipendula ulmaria*

Plate – 47

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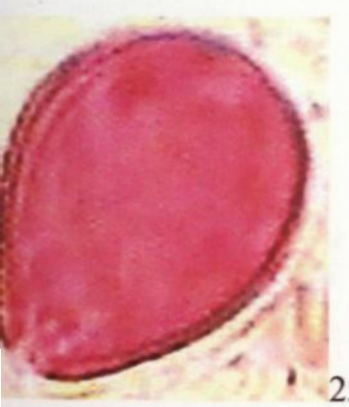

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FIG:23- *Myrtus communis* 24 – *cucurbita pepo*

25- *cucumis sativus* 26- *citrullus lanatus*

Plate – 48

27

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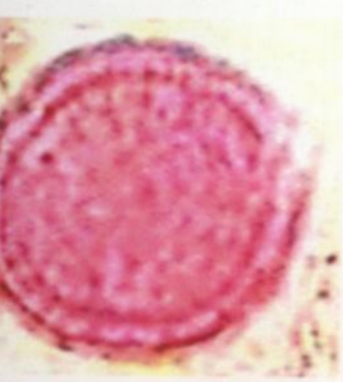

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FIG: 27- *Bupleurum fruticosum* 28-*Cornus sanguinea*

29- *Ambrosia maritima* 30- *Artemesia vulgaris*

Plate – 49

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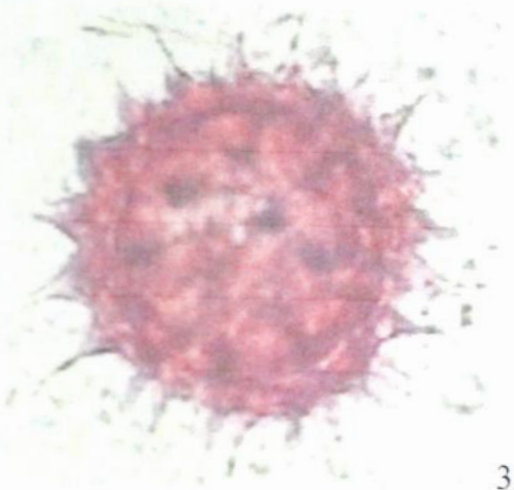

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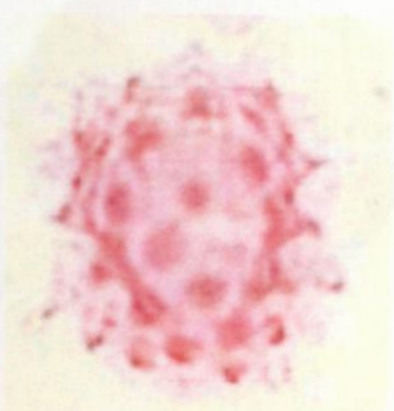

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FIG: 31- *Chrysanthemum sp* 32- *Helianthus annuus*

33- 34 - *Matricaria sp*

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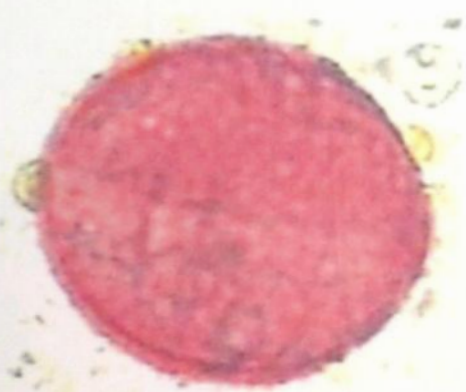

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FIG: 35 –*Michenia micrantha* *36- Cynoglossum creticum*

37- *Fagopyrum esculentum* 38- *Loranthus euspaeus*

Plate – 51

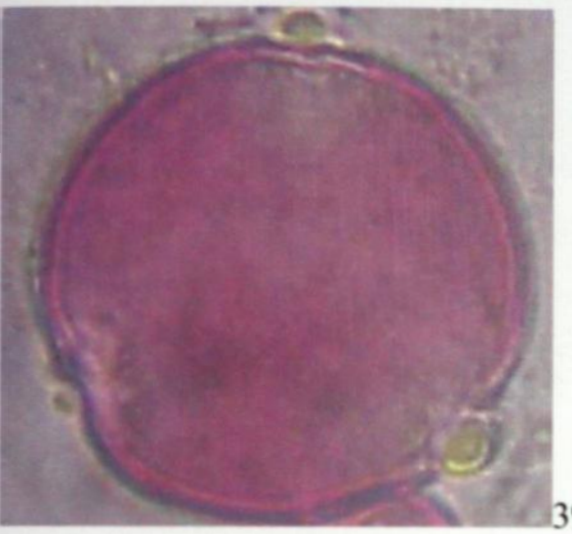

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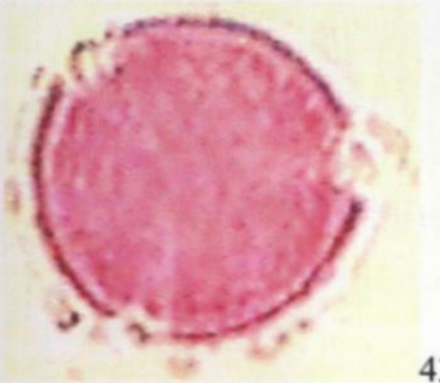
FIG: 39- *Mercurialis sp* *40- Urtica dioica*

41- *Juglans sp* 42-*Carpinus betulus*

Plate – 52



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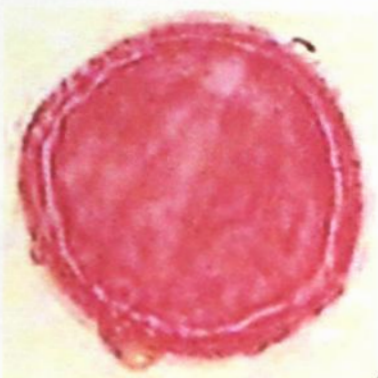

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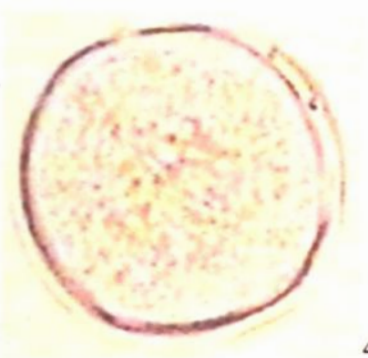

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FIG: 43-*Facus sylvatica* 44- *Populus trichocarpa*

45- *Salix triandra* *46- Musa x pradisiaca*

Plate – 53

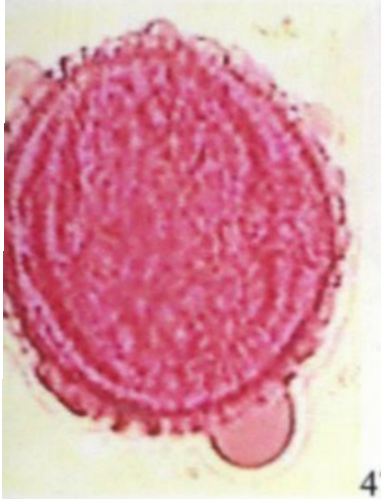

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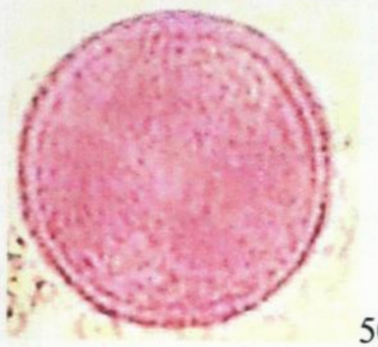
FIG: 47- *Crocosmia sp* 48- *Galanthus nivalis*

49- *Allium cepa*

Plate – 54



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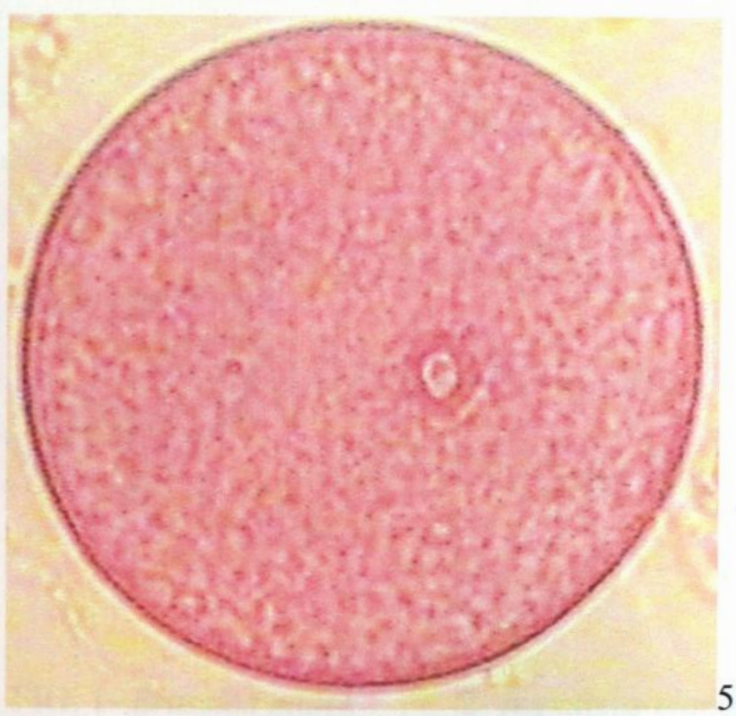

51

FIG: 50 – *Alopecurus pratensis* 51 – *Zea mays*

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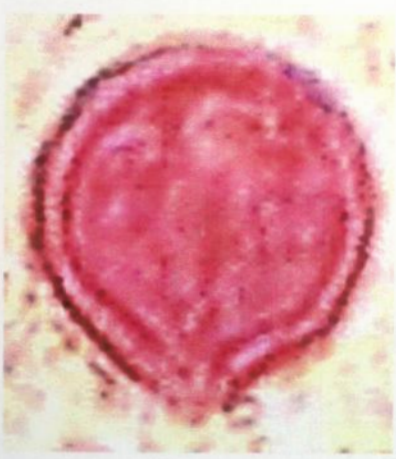

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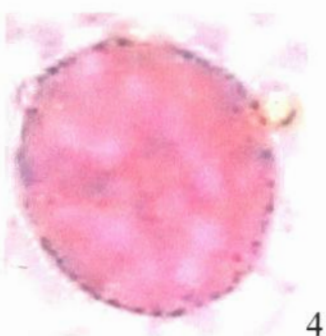

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FIG: 1- *Brassica napus* 2- *Impatiens glandulifera*

3- *Glycine max* 4- *Melilotus alba*

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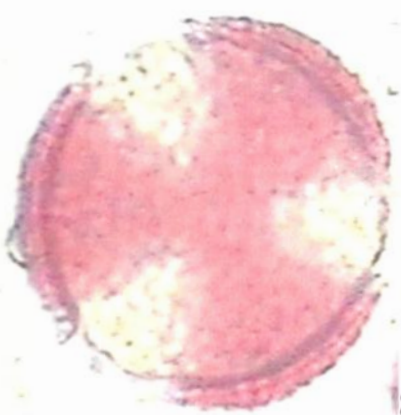

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FIG:5- *Prunus domestica* 6- *Bupleurum fruticosum*

7- *Alkanna tinctoria* 8- *Convolvulus arvensis*

9

FIG: 8-9 Fungal spores and mycelium

UNGAL SPORES AND MYCELIUM:.....


1


2


3


4


5


6


7

FIG: 1-7-Fungal spores and mycelium