# Melissopalynology :A General Account

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# INTRODUCTION



- Melissopalynology or mellitopalynology is the branch of palynology which deals with the botanical and geographical origin of honey by subjecting honey sediments to microscopic analysis for pollen grains contained therein.
- For over 100 years the literature pertaining to the study of pollen in honey has been termed or spelled in several ways, as mellissopalynology, mellittopalynology.
- The International Commission for Bee Research uses “melissopalynology”, which is therefore the term we adopted.
- While collecting nectar from flowers in the field, pollen grains are occasionally swallowed by bees and carried into the hive. There they are transferred together with the nectar from bee to bee into the storage cells to dry and turn to honey.

# DEFINITION

- Honey has been defined as a splendid sweet substance produced mainly by honey bees from the nectar of flowers.

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- It is an easily digestible food stuff containing a range of nutritiously important complementary elements with a high content of a range of saccharides.
- It is water soluble, may granulate between 10$^{o}$C and 18$^{o}$C , and is slightly acidic (pH 3.4-6.3). The sugars make honey hygroscopic and viscous.

**Honey:**

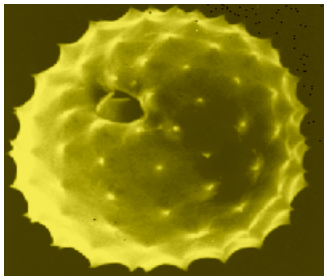
"Honey is the natural sweet substance produced by the honey bees from the nectar of blossoms or from the secretion of living parts of plants or excretion of plants sucking insects on the parts of plants, which honey bees collect, transform and combine with specific substances of their own, store and leave in the honey comb to ripen and mature"

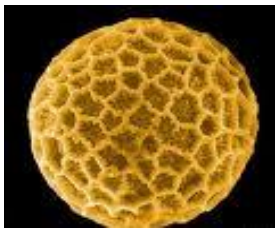
**What are Pollen pellets?**

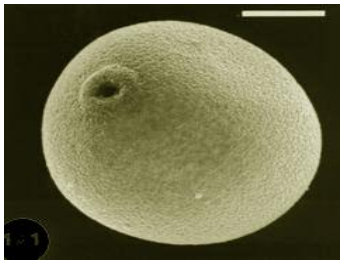
The hundreds or sometimes millions of pollen grains collected by honey bees is usually mixed with nectar or regurgitated honey and are packed with the help of special combs and hairs into structures called pollen pellets which stick on to their hind legs.

# POLLEN IS N'T JUST YELLOW DUST

- It comes in a vast array of shapes and sizes and has complex surface patterns and aperture openings
- Each plant type produces pollen (or spores) that are quite distinctive from those of other plants
- Usually, pollen types of species within a single genus look nearly identical
- Sometimes pollen types of genera within a single plant family will look similar or nearly identical
- In some plant families there is a great deal of variation among the pollen genera







# Pollination constraints (Shivanna, 2003)

- Reduction in native pollinator populations due to habitat degradation of pollinators.
- Extensive use of agrochemical like pesticides, insecticides and herbicides with drastic effects on native pollinator population.
- High density of plants in monoculture cropping system limited the availability of native pollinators.
- Crops introduced in regions where natural pollinators are absent.

# HONEY BEES

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- Honey bees are social insects, living in colonies of up to about 60,000 individuals. The colony is highly complex and each bee works for the good of the entire hive. The colony centers on its Queen. A fertilized female is capable of laying around a thousand eggs everyday.
- The main source of carbohydrate for bees is honey. Pollen collected from the anthers of flowers provides the essential proteins necessary for the rearing of young bees.

# Contd.

- Most of the world production of honey is obtained by the activities of honey bees, viz., *Apis mellifera* (occur mostly in Europe), *Apis cerana* (South East Asia including Indian Sub-continent), *Apis dorsata* and *Apis florae* (Indigenous to South East Asia).
- In India the stingless bees yield meager quantities of honey, but they increase our national wealth by selectively pollinating certain agricultural and forest plants.
- In India four indigenous bees belong to the highly evolved Apinae, among these *Apis florae* and *Apis dorsata* are primitive members, while *Apis cerana indica* and A. *mellifera* are tetraploid.

## Honey types:

1. If honey contains 50% or more pollen of one species , it is called **Uniflorae**.

1. If less than 50% then called **Multiflorae**

In India *Eugenia, Nephalicem, Citrus, Brassica* are common nector yielding species, While, Holoptelia, Alnus and Borassus etc are common pollen yielding species.

**The name of honey can be assigned on the basis of pollen Contained in it.**

(Nair & Chaturvedi, 1974)

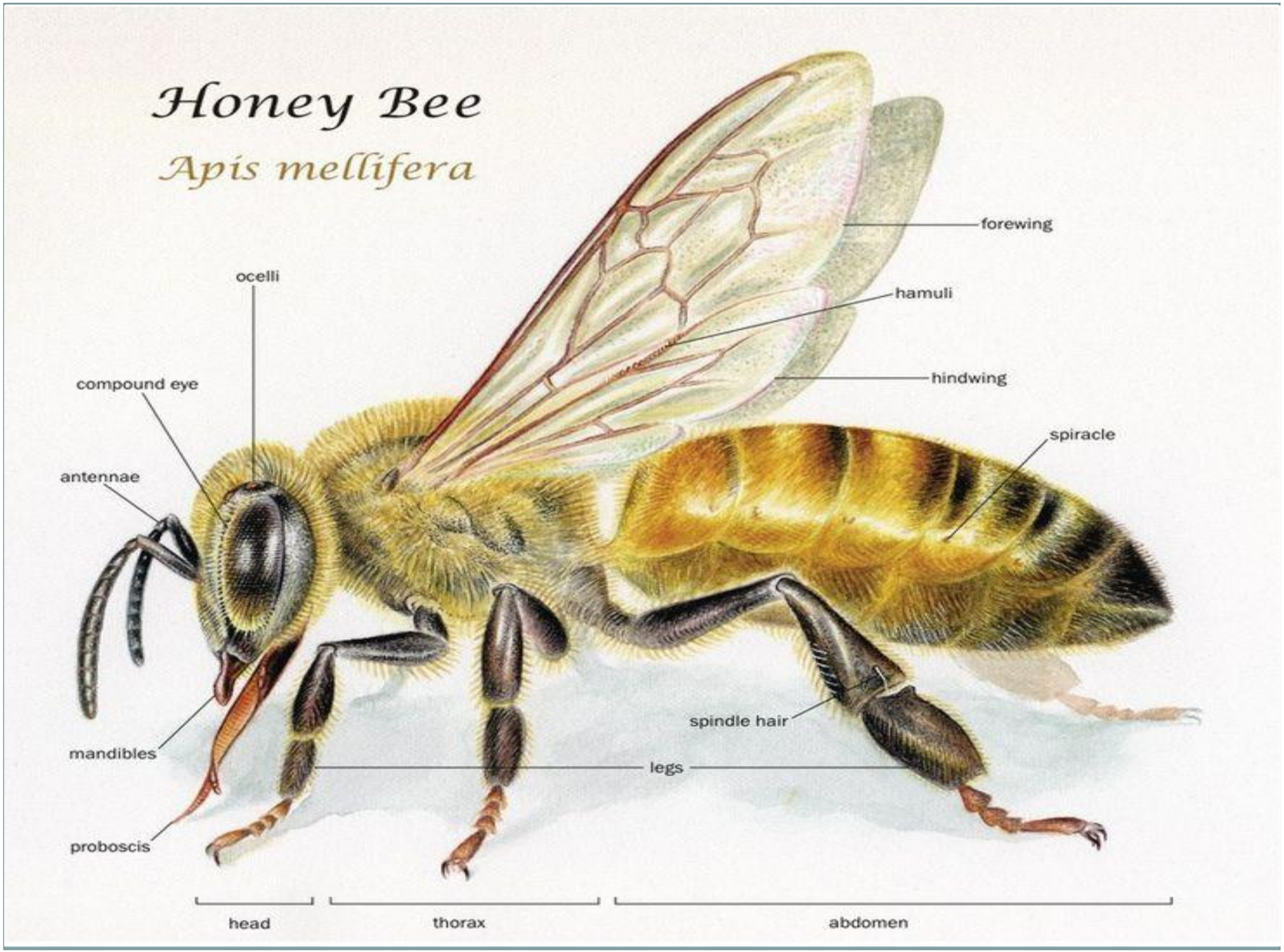
# Bees:

**For many insects and specially bees, pollen is the principal source of normal, non-liquid food. Pollen contains excellent nutrients for production of royal jelly, which nourishes the larval queen and young worker larvae.**

**The amount of protein & fat in nectar is insignificant.**

**Older workers bees use protein directly from pollen, queen images, larval queen and the young larvae of both sexes receive protein in the royal jelly produced by nurse bees supplied with pollen.**

**Thus pollen is essential for normal growth and development of individual bees as well as reproduction of colonies.**


Honey Bee
Apis mellifera
forewing
ocelli
hamuli
compound eye
hindwing
spiracle
antennae
spindle hair
mandibles
legs
proboscis
head
thorax
abdomen




Open Flowers



Tubular Flowers




Closed Flowers

# Methods of packing and gathering pollen:

**Parker (1926) classified them in to following groups:**

1. **Open flowers:** **The workers bite the anthers with mandibles and pulls them towards its body with its front legs while it runs rapidly over the flowers, all the while packing pollen into the baskets. E.g. Taraxacum, Rosa, Malus, Ulmus, Acer etc.**

2. **Closed flowers :** **The bee alights on the wing of the flower and separates the petals by forcing its fore-legs between them on either sides. The pollen is gathered on the mouth parts and fore-legs and packed in the usual way. Eg. Acacia, Robinia, Trifolium etc.**

3. **Tubular flowers :** **The bee alights on the corolla & inserts its proboscis into the tube in search of nectar. Collecting pollen is incidental to nectar gathering. The quantity of pollen obtained is small, it adheres to the mouth parts as forelegs.**

## 4. Spike or Catkin Flowers :

The bee may alight at the base of the lower part of the staminate flower, run up the catkin a short distance, then fly away to pack the gathered pollen and return to gather more.It may repeat the process several times.
In many cases the bee does not actually touch the catkin, but depends itself of Lasting towards the catkin and away from it.

## 5. Presentation flowers :

Flowers of this type present free pollen to the visiting insects. Apis bomes & Many solitary bee species press the abdomen against the inflorescence, causing a pollen mass to be pushed out of the disc flowers. Tubular flowers retract activity so that pollen is exposed. The collecting insect clamps to the corolla and the receptacle scale & in this way presses its body into corolla lead. Eg. Echinops sp.

**Time of Pollen Collection :**

It varies with different species and time of opening of flowers.
Three categories of opening: 1. Morning 2. Afternoon and 3. Evening.

Pollen collection may be different in different localities in same species. This is due to weather and climatic conditions.

The daily rhythm of pollen collection by bees is reasonably well Related to pollen availability of individual species.

**Color of Pollen Load :**

Uniform : It is of same color when pollen belong to same species,
Mixed : may be mixed in case of different species.
Segregated : Pollen is packed in different colors resulting in striped loads.
The plant source can often be identified from the color of pollen loads.

# Storage of Pollen in the Hive:

Adult bees store pollen primarily to consume in their own diets and to feed the larvae. On returning to the hive the worker bee seeks out an empty or partially filled cell. The hind legs are dangled into the selected cell and loads are stripped off by the middle legs. The pollen gathering workers have now finished its duty. Another bee generally a young one comes to break the load and stamps them down firmly into the bottom of the cell. A small amount of honey is deposited on the pollen to prevent spoiling. This store of pollen is called “Bee Bread” by the bee keepers. It requires about 18 loads to fill one cell. Because different pollen loads are mixed in storing the pollen, the filling of the cells is stratified.

## Pollen Pellet :

Size & weight of pollen basket loads collected by bees varies widely. The average weight of a load is about 7.5 mg which may be maximum upt o 15 mg. A very large amount of pollen can be collected by a colony in one day. In July about 250 gm of pollen requiring some 17000 flights were collected between 8 and 10 a.m. The total amount of pollen collected by one hive in a season varies between 15 and 40 kg.

Eckert (1942) calculated the pollen demand of one colony to be about 50 kg a year.

## Pollen Spectrum :

The pollen analysis of honey provides qualitative information about the forage plants at the collecting sites and depends on the soil type and seasonal flowering pattern. Adjacent colonies in a bee hive do not always produce honey with an identical spectrum.

# Chemical characteristics of honey

- The chemical composition of the honey is largely influenced by the composition of the pollen. In addition it is also influenced by the weather, soil and other factors. In fact no two honey are identical. Since the composition of pollen changes from species to species variation in absolute amounts of the different compounds can be very high.
- The major components are sugars, protein, amino acids and lipids.
- All amino acids essential to humans (phenylalanine, leucine, valine, isoleucine, arginine, histidine, lysine, metionine, theonine, and tryptophan) can be found in pollen with proline being the most abundant.

# CONCLUSION

- One of the goals of melissopalynology is to determine the floral sources and the geographical origin utilized by honey bees in the production of honey.

- Honey and its related products are rich in protein, in which these become partial source of vitamins, minerals and amino acids.

- These will aid in the construction of a pollen spectrum of a region, thus enabling to understand the source and establishing the authenticity of honey.

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