Generalitat de Catalunya
Departament d'Educació
Camp d'Aprenentatge
Granja Escola de Juneda

les obagues
ÉcoCentre

Bee keeping

Camp d'aprenentatge de Juneda

Teacher's Guide

SUMMARY

1 INTRODUCTION

Although we all have respect for the painful sting bees have, they are the insects which we have learnt more from their rich social life, their products and their anatomy.

The honey bee is a social insect and for this reason it can not live alone. The hive is composed of a variable number of members according to seasons.

Those who really know the bees are the bee keepers. Day after day and year after year, they take care of hives putting at our disposal all the products produced by bees. However, for most bee keepers, this job has been a complement to their economy. bee keepers, and farmers as well, know the role that their bees have in the recovery of vegetation, in the conservation of natural areas and the development of modern agriculture.

All this happens by means of the contributions bees make in pollinating plants.

2 THE ENVIRONMENT AND THE BEES

2.1 What is the role of pollinating insects?

Insects appeared on the Earth thousands of years ago and since then have evolved together alongside plants and flowers. Both have established a relationship that has become indispensable to each other.

To solve problems of genetic degeneration, some plants have been avoiding the auto-pollination, so they mainly have a cross-pollination. This means that the pollen of a flower fertilises the flower of another plant. Generally, there are two phases in the pollinating process of a flower:

- *the male phase*, in which the stamens are mature and produce pollen, but the ovary is not yet fully developed and it is impossible for the pollen to get to the pistil.
- *the female phase*, when the stamens have dropped all the pollen, the ovary is fully developed. Then it is time to take the pollen from other varieties to have good fertilization.

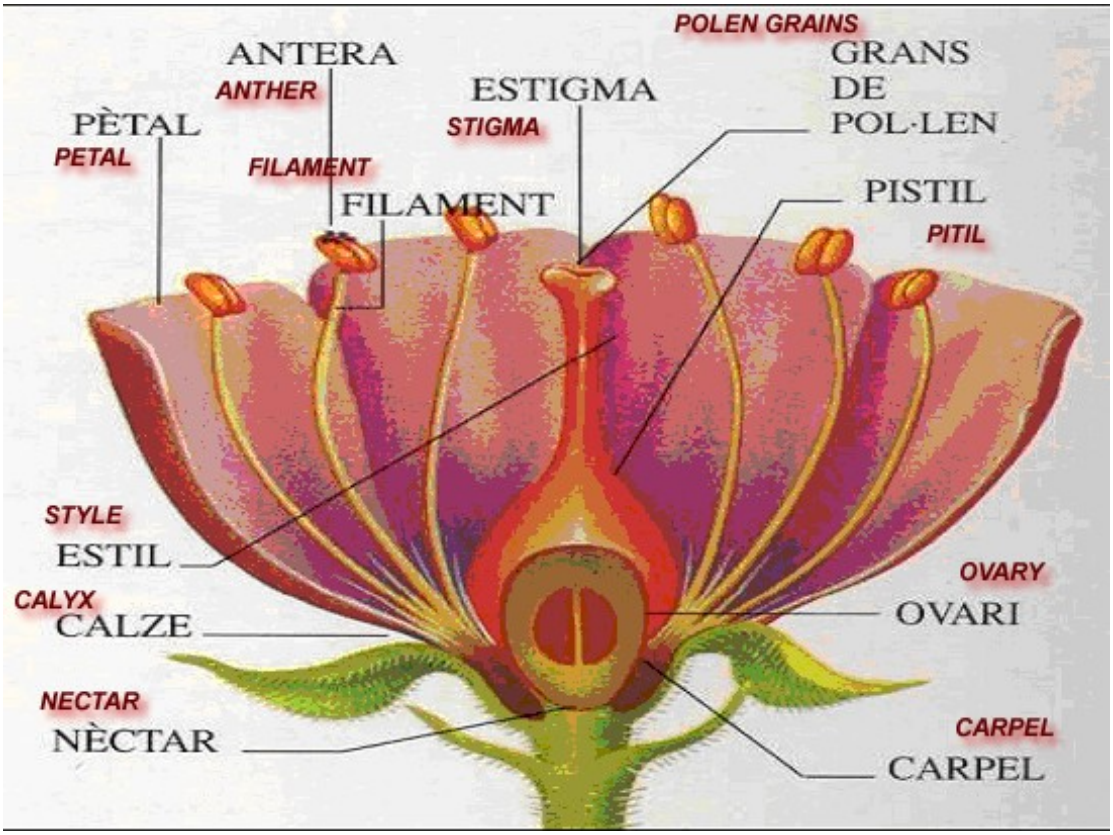

Fig.1 parts of a flower

The transportation of pollen between different flowers can be performed by several means:

- wind (anemophil pollination)
- water (hydrophilic pollination)
- some insects: bees, wasps, flies, beetles (entomophilous pollination)

Plants have developed systems to attract insects: bright colours that make them more easily detectable, large areas to take sugary substances from (nectar)

This curious relationship between insects and plants, which affects many species, is a kind of symbiosis where the insect gets food and the plants have their reproduction facilitated.

When an insect lands on a flower in male phase seeking the nectar that they use as food, which is often located in inner places of the flower, its body is impregnated with particles of pollen, which will fall down later in another flower in female phase. At this point, pollen can penetrate the pistil by the pollen tube in order to reach the ovule and fertilize it.

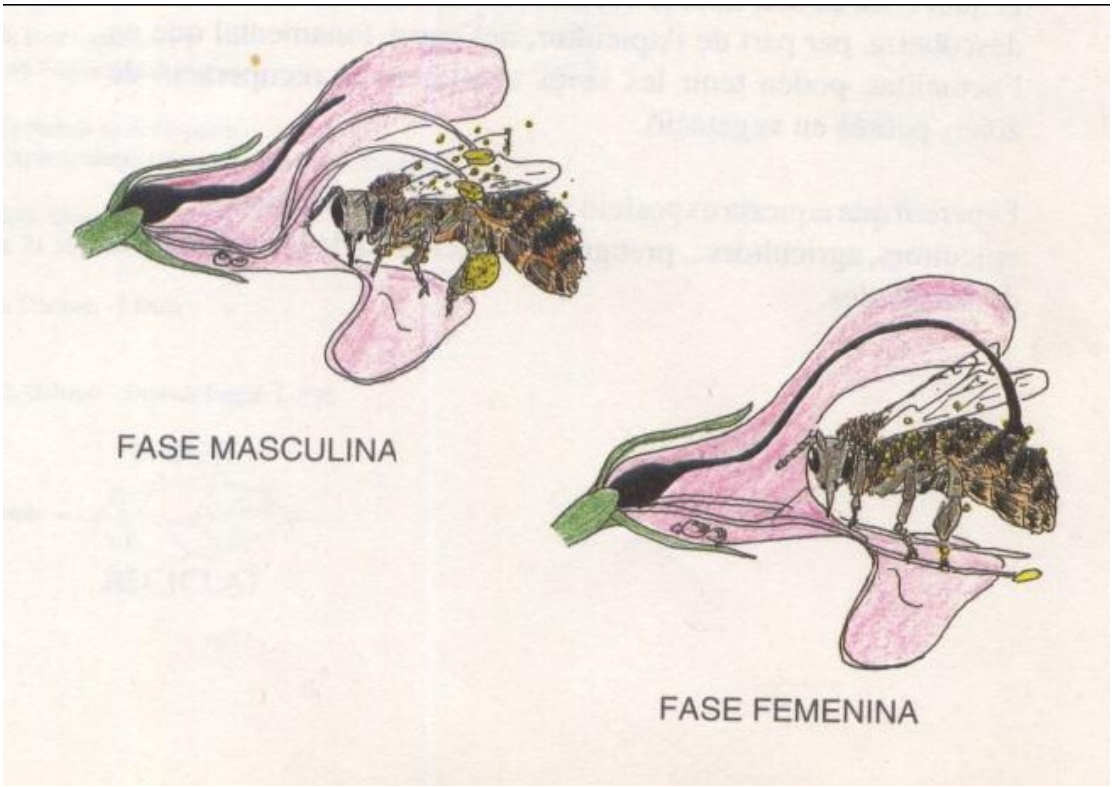

Fig. 2. The pollinating insects carry pollen that will fertilise the ovule from a flower in a male phase to another flower in female phase.

Some of the species that require an entomophilous pollinator to produce better fruit are:

- Forage legumes: alfalfa, clover, ..
- Fruit: apple, apricot, kiwi, blackberry, grapefruit, mango and some vine varieties, orange, peach and pear trees.
- Nut fruits: almond, chestnut and coconut.
- Vegetables: celery, aubergines, broccoli, peppers, leek, parsley, asparagus, Brussels sprouts, cabbage-and-flower, turnip.
- Oil: soy, bean, sunflower and cotton.

In modern agriculture, the particular behaviour of bees has been used as a benefit to increase the effectiveness of pollinating processes. Bees have mainly two tendencies when visiting flowers: they can act as non specialized insects and visit many different kinds of flowers or specialize in visiting always the same type of flowers. Both tendencies are interesting and used for agricultural benefits.

2.2 Bees and agriculture

In agriculture, using bees as pollinating insects not only increases production but also benefits plant health.

Besides the many advantages for agriculture, using bees as pollinating insects in order to increase production, it also entails a benefit to plant health. When bees build their honeycombs they produce wax that covers and protects the clutches of the dried up eggs of other insects, preventing the dissemination of harmful insects and the spread of pests.

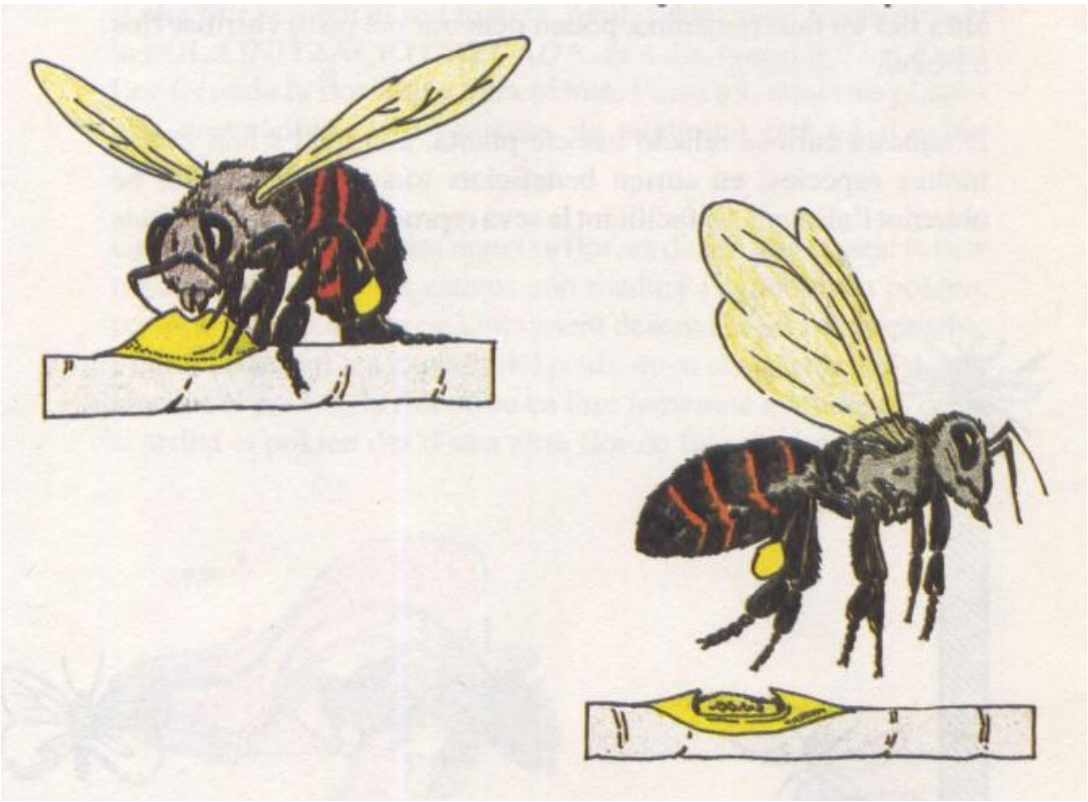

Fig.3. The advantage of the bees wax coating that protects the egg-laying of certain bugs.

To sum up, without the participation of bees, it would be impossible to obtain precious products such as honey, pollen or propolis from plants.

Through the history of bees we have learnt how to take advantage of the natural environment and we have transformed and adapted it to their needs.

The bee keeping and agriculture are a clear example of this. The technological advances of recent times have greatly contributed to the increase in production and agro-food products.

2.3 How have the changes in agriculture affected to pollinating insects?

- In large agricultural areas, the use of herbicides to control weeds from crops and field margins, lead to a lack of food for pollinating insects out of the flowering season of these crops. Populations of pollinating insects have many difficulties in finding food at specific times (winter and cold weather).
- In addition, the current tendency to use entire fields for the growing of crops, including the borders where weeds and wild flowers grew, means that the natural settings of many pollinating insects no longer exist.

The use of pesticides has a negative impact on all populations of pollinating insects, inevitably causing death. This effect can be very toxic if the application of these products is made outwith the flowering season and at a time when the insects are at their least active. Also in surface water, where the insects go to drink, there are unavoidable traces of products used. These will inevitably go into bees products, mostly honey.

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Therefore, we can see that this change in agriculture means a reduction in the population of pollinating insects, except in the case of bees, because of the existence of bee keeping.

The excessive expansion of species in nature always involves the spontaneous growth of other partner agents in the form of pests. In the case of bees, this is clearly illustrated with the existence of varroasis (Varroa jacobsonii).

The disappearance of any species is a loss of biodiversity which, in turn, prevents the study and future use of their genetic material.

3 THE BIOLOGY OF BEES

3.1 Individuals

Bees are insects that belong to the Hymenoptera order. Like any insect, their bodies are divided into three clearly differentiated parts:

- The head, where the sensory organs are, such as two compound eyes and 3 simple eyes, two antennae and a mouth, surrounded by two jaws and a long tongue used by the worker to get nectar.
- The chest, with the oesophagus and bags containing air and a strong muscle to drive the 2 pairs of wings. The 3 pairs of legs are also in this part of the body.
- The abdomen, including many vital organs, the digestive tract, air sacks, heart, excretory organs, the genital organs, two glands of poison and the wax glands (the drones don't have any of these glands).

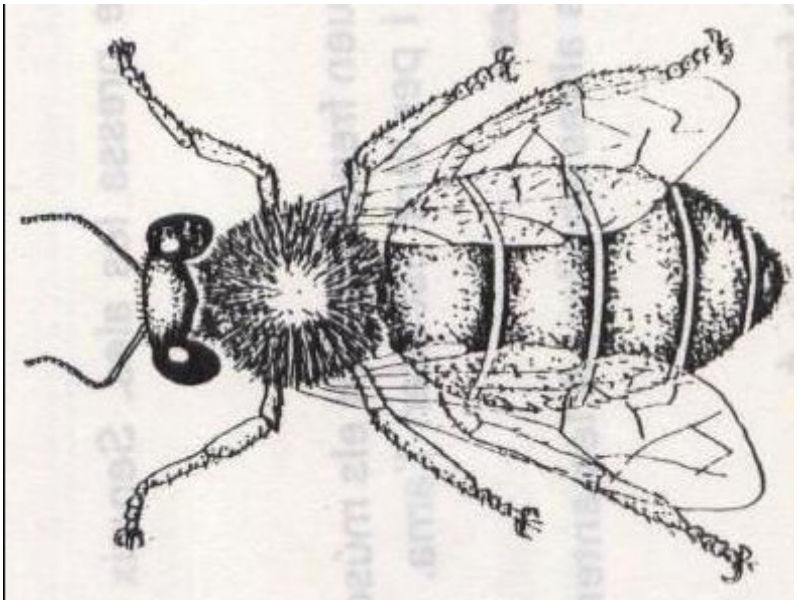


Fig.4. body of a bee

In the hive there are three different types of individuals: the queen, the drones and the workers.

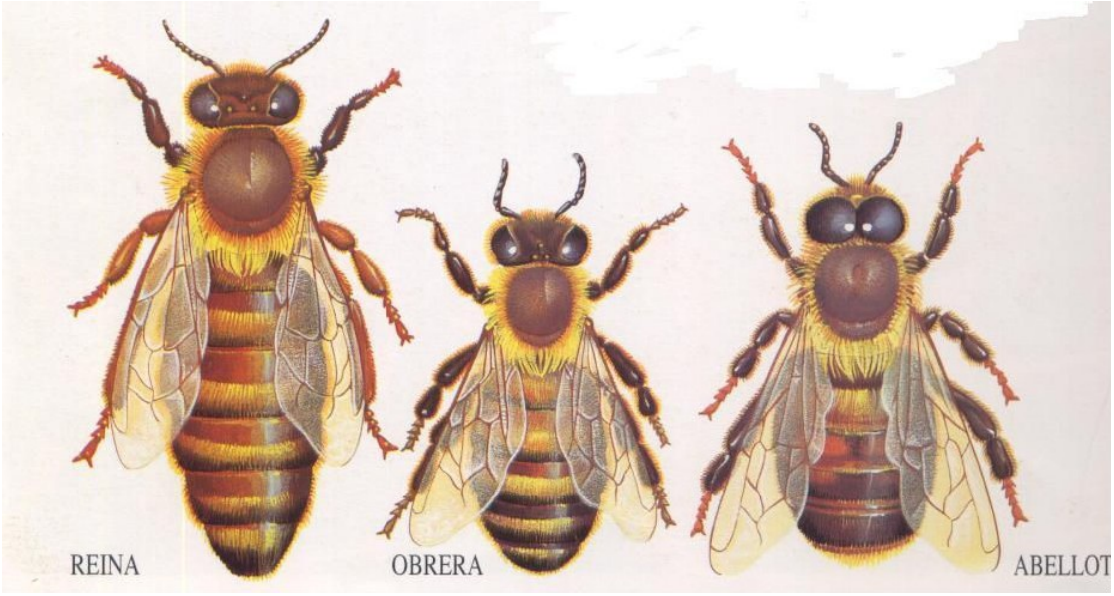


Fig.5. Inhabitants of the colony

3.2 The workers:

When we open a beehive, the workers are easier to detect. There can live from 30,000 to 60,000 in a colony.

They are **non fertile females** who do most of the tasks of the hive, depending on their age. Its size is about 15 mm long, being the youngest individuals in the community.

Up to twenty days of life, the workers first **clean the cells** (first 3 days), second, they **produce royal jelly** to feed the larvae, the queen and later they **secrete the wax**, **make and rebuild the honeycombs, store honey and pollen** that is delivered by their mates, take care and defend the hive ....

The rest of its life is devoted to outdoor work, such as collecting nectar, pollen, propolis and water.

Bees have a sting which they can use to defend themselves and the hive. The sting has the shape of harpoon and when they use it means the death of the bee, because it is impossible to remove without having the abdomen damaged.

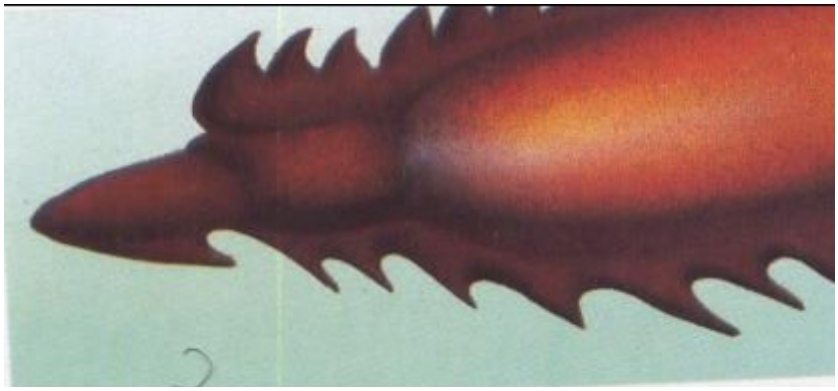


Fig 6. Harpoon of worker

Their average life is 3 months but can vary from 5 weeks to 6 months.

3.3 The Queen

The queen is **the female who fertilizes** the hive. There is only one in each colony and its main function is to **maintain the species**, laying until 3,000 eggs per day (maximum). Its abdomen is more elongated than other individuals and their length (20 mm) is also higher. It has a smooth and curved sting and only uses it to attack other queens.

His life is approximately from 3 to 5 years average. The queen comes from a fertilized egg cell (This cell is constructed as a sack and the size is much bigger than other cells; Royal Cells). Both larvae and adult queens are fed only with royal jelly.

When she leaves the royal cell, the queen bee uses her sting to kill other queens that are growing in other royal cells.

When the queen bee has a few days of life, about two weeks, she does **the nuptial flight** outside of the hive, flying about 20 meters above the fields. Behind her come the drones, attracted by its smell (pheromone. ..). Males can cover the bee and fertilize her. Before the sexual act the drone dies.

When the queen has been fertilized flies back to the hive where she will remain for the rest of his life and will be devoted almost exclusively to lay two types of eggs: **fertilized eggs** (from which female bees, queens or workers, will be born) **non fertilized eggs** (from which the drones will be born). This is possible because of the queen's reproductive apparatus consisting of a bag called spermatheca (containing the sperm of drones) and both ovaries.

When laying the eggs, they go through the oviduct (the tube that connects the ovary to the vagina), while some sperm comes to fertilize them.

It is not known whether the use of sperm to fertilize the egg depends on voluntary movements of the queen or simply it is a mechanical function.

The fertilised eggs are laid by the queen in cells and from them only females are born. Non fertilised eggs are laid exclusively in drone cells and thus they produce males.

The second function of the queen is to regulate all the activities of the colony through the emission of its pheromone.

This pheromone, also called royal substance, is secreted by glands and it is spread across the whole surface of its body. The workers of 1 to 36 days old, caress the queen with their antennae and their tongues to collect the pheromone and distribute it

among all the inhabitants of the hive. This substance allows them to know that the queen is present and so the colony continues with its normal activity.

It is known that inside the hive, the pheromone:

- Attracts young bees
- Prevents the construction of royal cells
- Avoids the development of the workers' ovary.

3.4 The drones:

In a hive their number varies between 200 and 400 individuals.

Fertile males are born out of non fertilized eggs (by parthenogenesis). The operculum of the cells of the drones are prominent and rounded.

They are about 17 or 18 mm in length, have no sting, their eyes are much larger than other bees, the abdomen thicker, and their shorter legs have no useful work. Their flight is more noisy than other individuals.

The drone has only one skill during his life. He is only responsible of fertilizing the queen.

This fertilization takes place during the nuptial flight. This means that the queen attracts the drones by the smell (pheromone). There can be no doubt that they follow up to cover it. Only a few males can cover and fertilize the queen bee. In this moment, they are ripping the abdomen causing them death.

The other drones, normally in winter, are rejected by the colony and even the workers try to attack them if they try to re-enter the hive.

The fact that these males are incapable of feeding themselves outside the hive causes that they can't survive outside the colony and therefore are starving to death.

His life is approximately of four months.

COMPARATIVE TABLE WORKERS, QUEEN, DRONES

	WORKER	QUEEN	DRONE
Body lenght (mm)	12-13	18-20	15
Chest Width	4	4.2	5
Weight (mg)	100	250	230
Position of compound eyes	separated	separated	contiguous
Length of the tongue (mm)	5-7	Very short	Very short
Legs	With tools	Without tools	Without tools
Sting	present	present	absent
Duration of development (days)	21	16	24
Wax glands	present	absent	absent
Living (average)	A month	5 years	4 months

4 The development of bees.

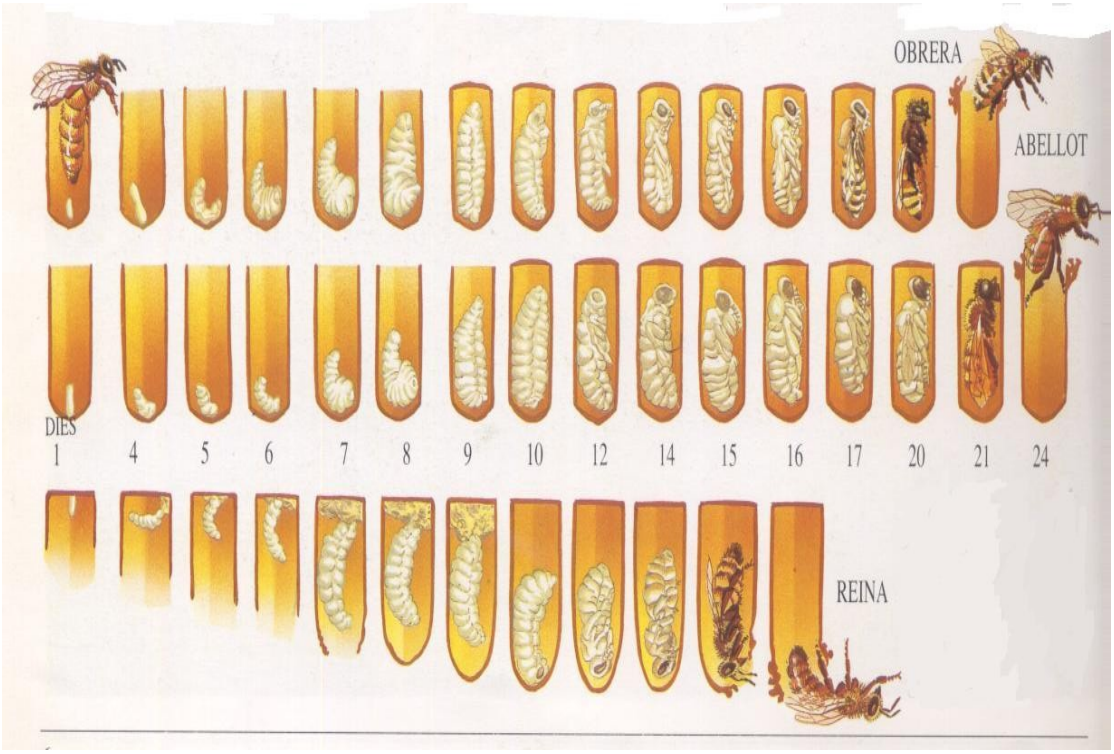


Fig.7. Gestation time of eggs and larvae

The life of bees comprises two distinct phases:

- first, going from the laying of the egg until the birth of the adult insect.
- second, that begins with the birth of the adult insect and ends with its death.

In the first phase, and no matter if a worker bee, a drone or a queen is concerned, there are three distinct stages

- **egg:** It is hold for 3 days in an open cell. First it lays perpendicular to the bottom of the cell and then gradually slopping until it is lying in the background.
- **larvae** (6 days) in an open cell. The larvae is a kind of worm, increasingly bent in the cell, which grows rapidly and eventually filling the cell. Being fed between 10 to 100 times per hour, the larvae consume all the food that the workers bring them. The last four days of the larval stage the cell is open, and -very important- if the larva of a fertilized egg is fed with a mixture of water, honey and pollen, the worm undergoes a kind of castration and therefore that larvae will become workers.
- **spinning the cocoon, resting and nimfosi stage**, inside the cell which is covered with wax during 12 days. At the end of its development, the larva is isolated in his cell by a porous plate wax, a cocoon (2 days), resting and moulting for the last time (3 days), then undergoes metamorphosis (7 days). Twelve days after the cover of the cell, is broken by the adult bee and exits the cell.

In the second phase (and according to the explanations in the section of the type of individuals) each adult will be devoted to carrying out its functions:

- The **queen**, between 5th and 15th day after its birth does the nuptial flight and from 2 to 5 days after mating will be devoted to laying eggs throughout its life.
- **Workers**, first being fed with pollen and nectar, and honey after, will be devoted to do different tasks based on their age:
    - **Incubators**, 1st to 6th day. Their main function will be to clean the cells after the birth of a new worker.
    - **Feeders**, from 6th to the 15th day, to supply the larvae with royal jelly they produce with their jaws and mouth glands.
    - **Sweepers, heaters, steve doring, guards, builders** ...., from the 12th to the 20th day. - Harvesting. After a variable number of weeks of work within the hive, the workers are dedicated to collects different products, such as nectar, after some time, pollen and finally water and propolis.
- The **drones**, will be feeding and waiting up to the moment the queen does the nuptial flight out to fertilize it.

4.1 The honeycombs

Fig. 8. Frame

Inside the hives, bees build structures out of wax, that are flat and rectangular (in the case of the hives, they have a framework) or bag in hives constructed in trees, called honeycombs.

These honeycombs are formed by hexagonal boxes, called cells. They are built through the secretion of wax (the wax glands) of the worker bees that are between 12 and 18 days of age and use their jaws to shape this wax.

The workers need abundant energy to secrete the wax. To make a kilogram of wax they must fed themselves with 10 to 12 pounds of honey.

Within a honeycomb not all cells are equal, their shape and size depends on the content that bees keep in. We find:

- Small cells: used to store honey, pollen and to lay eggs that will produce workers. When the cell is full of honey it is closed with white wax forming a thin operculum. The pollen, however, is not closed.
- Bigger cells: they contain the setting that will rise the drones and may also contain honey.
- Cells located at the end of the honeycomb, with elongated, rounded shape are royal cells, where the larva will turn into a queen bee.

Fig.9. Royal Cell

The situation of the different elements in the hive forms a kind of circle. The cells containing eggs are in the centre, which are surrounded by a ring of cells with pollen and honey cells at the edges.

4.2 The Swarm

When a hive has a large population and external flowering conditions are optimal, a new swarm appears as a result of the partition of a colony in two. A whole swarm of bees, together with the queen, leave the hive to find a new home. It is clear that the bees may be ready to provide a new queen, so that they have already built royal cells inside the hive.

During the swarm, bees do not sting because they have filled their stomach whit honey, in prevention of a long trip before they find a new place to live. This research is organized by the workers since the announcement of the departure to the final new installation.

5 Communication and social life

Of all the activities carried out by bees, its rich social life and its peculiar system of communication, are the most unique.

Regarding the language used by workers doing the job of explorers, this is called "dance" as a kind of evolution that make these individuals to communicate with their peers, telling them about the location of a food source and the approximate distance of this. We know two kinds of dances:

- **Loop Dance:** Once the workers have deposited the honey in the cell the beginning of the dance happens. It is a way to tell the workers that the food site is found near the hive, less than 100 m. The bee dances in a circle, either

right, or left, followed by other workers who are touching the "dancer" with their antennae.

Fig.10. loop dance

With fast steps describes a series of circles around the portion of the panel where the nectar is located.

- **Shake dance:**With this movement the workers indicates that the flowers to collect nectar from are found farther than 100 meters from the hive. The dance is done by a "dancer" in the form of two semicircles. First walking in a straight line, but shaking the abdomen nervously and then drawing a semicircle on each side of the straight line. The line indicates the direction to follow, having the sun as a reference, and the number of semicircles that they make are proportional to the distance that the bees must go to find the food. The strength in the dance is an indication of the amount of food that the discovery can provide.

Fig.11. shake dance

Other activities of interest bees do in the hive are:

- Temperature control inside the hive by the younger bees. They must keep the hive up to 34-35 ºC to ensure the development of larvae.
- Cleaning and organized the hive ...
- The swarms ...
- Chemical communication or transmission of information throughout smells (feromones).

Corrected up to this point

6 BEE PRODUCTS

We must necessarily distinguish between:

- product collected by bees
    - nectar
    - propolis
    - pollen
- products made by bees
    - honey
    - wax
    - royal jelly
    - bees venom
    - bee bread
- products harvested by the bee keeper
    - honey
    - pollen
    - wax
    - royal jelly
    - bees venom
    - propolis
    - bee bread

The **NECTAR** is a sugary substance, produced by flowers to attract insects such as bees. This product contains between 60 and 70% water.

The bees visit a lot of flowers on each trip and take a small drop of nectar from the pistil, sucking it with their long tongue. So when they have filled their stomach they return to the hive. At this moment the transformation of this nectar into honey begins. During the transport the worker bees add enzymes and ferments to split the complex sugars (disaccharides) of nectar, into simple sugars (monosaccharides).

The **HONEY** is the product made by bees from the nectar collected in flowers. They mix it with their own enzymes in the mouth. Finally, the bees make an aqueous solution of glucose and fructose, in addition to small amounts of sucrose, maltose and enzymes. Once the worker arrives full of honey at the hive, another worker takes the substance and repeats the process of passing the mixture to a mate several times until it becomes honey. At this moment it is deposited in a cell where it loses part of the moisture because of the circulating hot air within the hive. Once the cell is full, they finish the work by closing the cell with a wax cover.

The honey has many nutritional properties, used as healing treatment and acting as a strong bactericide.

To produce 1 kg of honey 50.000 trips of bees to and fro flowers are needed.

The production of honey in an average hive is 16 to 20 kg a year.

The composition and characteristics of honey depend on the botanical source of nectar, but we can state that the average composition (%) of honey, is as follows:

Water	17
Glucose	31
Fructose	38
Maltose	7.5
Sucrose	1.5
Polysaccharides	1.5
Other substances	3

From a commercial point of view, honey is classified according to the botanical origin and colour.

- according to botanical origin:
    - Honey from one flower. It is the nectar of flowers honey comes from that gives it the name. (Orange honey...)
    - Honey from many flowers. It case of nectar collected from many flowers, honey gets the name of "a thousand flowers" honey.
    - “Mielato” honey. It doesn’t come from the nectar of flowers. It comes from other sugary secretions plants have and bees collect them to produce food. It is called forest honey and gets its name from the plant bees visit.
    - Honey is classified depending on the colour. The colour is a physical characteristic related to the origin of floral nectar and in close relation with the content of minerals and other minor compounds (dextrins and nitrogenous materials). The colour of the honey is measured by the scale *Pfund.*

The international designation for the colour is as follows:

Denomination	mm. Pfund
White	0-34
Extra light amber	35-48

Light amber	49-83
Amber	84-114
Dark amber	Above 114

Fig.12. different honeys according to their origin.

POLEN is produced by flowers in their male reproductive system. This reproductive system is used to fertilize female flowers of another plant, to produce the fruit.

This product is also collected by bees as food for larvae and adult workers. The bees collect the pollen from the anther of the flower, and make a mass in the mouth, turning it into a small yellow or orange ball the workers carry on their rear legs. The bee keeper takes it by means of a pollen trap placed at the entrance of the beehive. A bee gathers about 15 mg. of pollen per trip.

The pollen contains many proteins, mineral salts, lactic acid and enzymes, some fats and sugars.

The average production of a hive is 2 to 3 kg / per season.

It is a product that has therapeutic and cosmetic properties. We can say that the average composition of the pollen is as follows (%):

According to the magazine "El Campo"

Water	8
Proteins	15-20
Amino acids	2.0-2.5
Carbohydrates	34-50
Ashes	1-2
Crude fibre	4-6
fat	4-8

According P.J. Prost (p. 414)

water	30-40 %

Proteins	11-35 %
Carbohydrates	20-40 %
Fat	1-20 %
Minerals	1-7 %
Resins, dyers, vitamins (A,B,C,D,E) enzymes, antibiotics, etc	traces

6.1 Royal jelly

Royal jelly is secreted by pharyngeal salivary glands of young bees. It is intended to feed the larvae in their first 2 or 3 days of life. The queen bee is fed with royal jelly throughout her life.

Its composition is approximately 68% water, 12% protein, 5% of fats and other substances are an important biological activity such as vitamins: B1 (thiamin), B2 (rivoflavina), B6 (pirodixina), B12 (cyanocobalamin), niacin and pantothenic acid, C, D, nucleic acids and mineral salts and in particular 10-hydroxy-acid decenoic that confers antibiotic and anti fungal activity to the jelly, leading to its conservation.

To gather the royal jelly, the bee keeper should force the hive to start feeding future queens, emptying every two days the royal cells (0'2 gr. of jelly each one).

The production is about 250 g / hive per intensive season.

The jelly has attributed important therapeutic properties.

The **PROPOLIS** substances are composed of essential oils and resins that bees collect from buds and barks of certain trees.

Bees, with the help of the jaws, carry them off to the hive in the baskets of their back legs

These products are used to close gaps, strengthening the honeycombs. The bees can use it as a disinfectant to clean the cells where the queen will deposit their eggs and for embalming and isolating outsider animals the bees have managed to kill inside the hive but can not remove because of their size (mice, beetles, butterflies ...). Wrapped up with propolis do not smell and they dry slowly.

The annual output of a hive are about 200-300 g. Propolis is a product for therapeutic use (as alcoholic extract for skin diseases and also is used to form part of the composition of varnishes and glues.

The **WAX** is secreted by wax glands. Its a product that the bees have in the lower abdomen. It is a mixture of fatty substances. From a chemical point of view fats or lipids are ether salts and combination of alcohol and fatty acid. Both, wax and fatty alcohols, have a high number of carbon atoms.

This wax, after being secreted in the form of scales, is chewed and used to build each of the cells that form hexagonal honeycombs. Bees carry out the construction of honeycombs, hanging off their legs and going to shape the wax and the cells from top to bottom. These cells are built with a slight inclination to prevent their content from

eventual dropping. The hexagonal cells of honeycomb can store 3 to 5 pounds of honey.

A worker must consume 10 to 12 kg of honey to secrete 1 kg of wax. Therefore, the bee keeper usually provides with sheets of wax each frame of the hive, to facilitate the construction of honeycombs bees, preventing an unnecessary effort made by the bees. Nowadays the use of this wax in the industry has declined considerably, as it has been replaced by paraffin and vegetable waxes.

The **BEE VENOM** is the poison of bees. Produced by two abdominal glands that are related to the sting through the poison muscle. The sting, shaped as a hook is located at the end of the abdomen of the bees, as is an adaptation of the organ of laying females.

The workers, usually only attack using the sting when they feel themselves threatened and in order to defend their community. When the bee stings, the sting is stuck into the skin, along with the poison vesicle (empties slowly with the help of muscle contractions). The loss of the sting provokes the death of the bee in a few minutes.

The collection of poison is one of the more complicated techniques of beekeeping.

The apitoxina is very important in the manufacture of medicinal products, to deal with rheumatism, arthritis and other diseases.

The **BREAD OF BEE** is pollen stored by bees in the cells of the honeycombs.

Shortly after being stored it is transformed under the influence of substances that the bees produce, certain micro organisms, the conditions of temperature and humidity in chambers containing breeding and conservation conditions of cells, where bread is stored and compressed by bees. All this gives the bread a nutritional value to bees higher than pollen.

6.2 THE BEEKEEPING

Bee keeping is a professional activity that aims to raise the population of bees and take care of them and use the substances that collect or produce. Those who perform this great work are called bee keepers.

We have to go back to the Egyptian time, four thousand years ago, to locate the first bee activities, similar to what we know nowadays. These are regular activities to take care of bees:

Build them dwellings

Use of wax, honey, pollen and propolis.

The work of the bee keeper, at present, is described as "a highly specialized agricultural activity" and therefore is quite complex to explain how their work develops.

The modern bee keeping is founded on three fundamental aspects:

- Knowledge of the biology of bees, which makes selection possible through artificial insemination techniques, in order to get the best races to increase benefits.
- Knowledge of the plants and flowers to achieve a good revitalization of damaged areas, to obtain a good honey production.

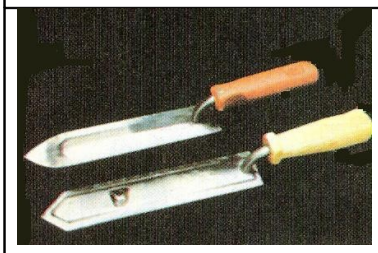
- Knowledge of modern agriculture to achieve a balanced exchange between agricultural production and bees.

6.3 Machines and tools of the bee keeper

- machinery, tools and instruments: Hive Type: On the peninsula are mainly used two types of hives (Layens, Dadan ,...)
- Parts of the hive:
    - Box (containing the entrance)
    - Metal cover
    - Feeder
    - Wood cover
    - Frames: Are wooden pieces that support a wax frame (wax printed sheet) attached to wires. Installed inside the hive, let the bees build honeycombs on and be manipulated by bee keepers without being broken.

- There are different sizes and models, depending on the type of hives.

TOOLS OF THE bee keeper

 Smoker	 Mask	 Gloves
 Decapped knife	 Wax printmaker	 Thermometer
 Pollen trap	 Queen excluder grid	 Scraper Brush
 Centrifugue	 Hive tool	 Wax melter

7 THE BEEKEEPING WORKSHOP

This workshop lasts approximately three hours and takes place in three different areas:

7.1 The classroom of bee keeping:

During one hour, in this room there is a sharing of knowledge about bees and from this base, it is developed an introduction to the social life of these insects, their morphology, anatomy and biology. Also about different products that bees provide, their properties and their application or use as human food.

Finally, with the projection of different materials and photographs the work of the bee keeper is commented, a reference to men built hives and tools available. A final reference to different moments in the life of bees : metamorphosis, collecting pollen

7.2 The Bee Farm

It is a place outdoors at a walking distance where different hives are located.

The visit takes place after children and teachers are safely dressed. A folder to monitor the data is provided. All necessary tools, the smoker, straw and thermometer are provided, some basic instructions related to behaviour are commented in order to avoid a bee sting (avoid sudden moves, not to shout and not to hit the hive, etc).

The visit consists on the observation of one of the hives, trying to perceive what has been learned in the bee keeping classroom . The bee keeper, after taking the temperature outside and inside the hive, takes out the 10 frames, one by one, and passes them carefully to the kids that are distributed in a semicircle around the hive. Any observation (births, laying of eggs, presence of drones, queen, diseases, ...) is commented and noted down carefully.

We take advantage of the visit to learn and take records about the weather, the bee population, the activity in the hive, the amount of honey and breeding status, etc..

7.3 The honey classroom

In this room there is the honey extraction equipment (wax melter, dryer, storage tank and containers of honey). The equipment to prepare and recycle boxes (layers of wax, wax stampers, spinning drums, wires, blades ...).Whenever it is possible, depending on honey production, our student can experiment the full process of honey extraction.

The workshop ends in this room with the preparation of a small single comb base made by each child from wax using the printmaker.

Also at this point, a taste of honey and pollen is provided.

8 COMPARISONS AND SAYINGS RELATED TO BEES.

“When the flower blooms, the bees come uninvited.”

“Don't wear perfume in the garden - unless you want to be pollinated by bees”.

”No bees, no honey; no work, no money”

“When you go in search of honey you must expect to be stung by bees.”

“Books are the bees which carry the quickening pollen from one to another mind.”

“Until you have smoked out the bees, you can't eat the honey.”

“No shade, no shine, no butterflies, no bees,/ No fruits, no flowers, no leaves, no birds, - November!”

And a poem

“A flock of sheep that leisurely pass by,

One after one; the sound of rain, and bees. Murmuring;

the fall of rivers, winds and seas,Smooth fields,

white sheets of water, and pure sky;

I have thought of all by turns, and yet do lie

Sleepless!”

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10 ILUSTRATIONS

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