



BEEKEEPING IN YOUR BACKYARD.

A beginner's guide to keeping bees as a hobby.

Michael Birt.

Beekeeping in your backyard is a book focused entirely on the beekeeper who is starting out on this fascinating world of keeping bees.

Split into sections covering

- The purpose of keeping bees.
- The benefits of beekeeping.
- Hive Inhabitants.
- Equipment need to get you going.
- Parts of the hive
- Bee Biology
- Bee Pests and Diseases
- Basic Manipulations.
- Honey extractions
- Winter work.

In fact all you will need, as a beginner, to know about starting up on this fascinating, rewarding hobby.

Beekeeping in your Backyard.

A guide to basic beekeeping for the hobbyist beginners.

Michael Birt

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Before leaving, I would like, dear bees, to carve my name on these leaves, blessed shrub that
has taken all its sap from around your dwelling place.

In its shade, I have rested from my weariness, have healed my wounds. Its horizon satisfies my
desires for there I can see the heavens.

Its solitude is more gentle than deep. Your friends are visiting it. You enliven it with your
singing.

And because you do not die, dear bees, you will sing again and for ever, in the surrounding
foliage, where my spirit will rest.

Thank you.

E. Warré



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1. The purpose of keeping bees.



Apiculture or beekeeping is the art of managing bees with the intention of getting the maximum return from this work with the minimum of expenditure. Bees produce swarms, queens, wax and honey. The production of swarms and queens should be left to specialists. The production of wax has some value, but this value is diminished by the cost of rendering. Propolis and Royal Jelly are becoming more and more popular especially amongst the more health conscious amongst us but as far as the beginner beekeeper is concerned is a more specialised subject and for this reason I have left the subject alone in this book.

The production of honey is the main purpose of beekeeping, one that the beekeeper pursues before everything else, because this product is valuable and because it can be weighed and priced. Honey is an excellent food, a good remedy, the best of all sweeteners. We can sell honey in many forms just as we can consume it in many forms: as it is, in confectionery, in cakes and biscuits, in healthy and pleasant drinks, mead, apple-less cider, grape-less wines. It is also worth noting that beekeeping is a fascinating activity and consequently rests both mind and body. Furthermore, beekeeping is a moral activity, as far as it keeps one away from bars and low places and puts before the beekeeper an example of work, order and devotion to the common cause. Moreover, beekeeping is a pre-eminently healthy and beneficial activity,

because it is most often done in the fresh air, in fine, sunny weather. For sunshine is the enemy of illness just as it is the master of vitality and vigour. Dr Paul Carton wrote: 'What is needed is to educate a generation in disliking alcohol, in despising meat, in distrusting sugar, in the joy and the great benefit of movement'. For the human being is a composite being. The body needs exercise without which it goes fat and listless.

The mind needs exercising too, otherwise it deteriorates. Intellectuals deteriorate physically. Manual workers, behind their machines, suffer intellectual deterioration. Working on the land is best suited to the needs of human beings. There, both mind and body play their part. But society needs its thinkers, its office workers and its machine operatives. Clearly these people cannot run farms at the same time. But in their leisure time (they must have some of it) they can be gardeners and beekeepers and at the same time satisfy their human needs. This work is better than all modern sports with their excesses, their promiscuity, and their nudity. Thus if the humans were to return to the land they would be more robust, more intelligent. And as a wise man once said, the world would again become the land of balance where there would be neither the agitations, nor the collective follies that are so harmful to people; it would become again a land of restraint and clarity, of reason and wisdom, a world where it is good to live. Let us not forget the advice of Edmond About: 'The only eternal, everlasting and inexhaustible capital is the earth'.

Finally, one more important thing: the bees fertilise the flowers of the fruit trees. Apiculture thus contributes greatly to filling our fruit baskets. This reason alone should suffice to urge all those who have the smallest corner of orchard to take up beekeeping. According to Darwin, self-fertilisation of flowers is not the general rule. Cross-fertilisation, which takes place most commonly, is necessitated either by the separation of sexes either in flowers or even on different plants; whether because the non-coincidence of maturity of pollen and stigma or by the different morphological arrangements which prevent self-fertilisation in a flower. It happens very often that if an outside agent does not intervene, our plants do not fruit or they yield far less; many experiments demonstrate this. As Hommell put it so well: the bee, attracted by the nectar secreted at the base of the petals, penetrates to the bottom of the floral envelope to drink the juices produced by the nectaries, and covers itself with the fertilising dust that the stamens let fall. Having exhausted the first flower, a second presents a new crop to the tireless worker; the pollen it is carrying falls on the stigma and the fertilisation which, without it, would be left at the mercy of the winds, takes place in a way that is guaranteed. Thus the bee, following its course without relaxation, visits thousands of corollae, and deserves the poetic name that Michelet gave it: the winged priest at the marriage of the flowers. Hommell even attempted to put a figure on the benefit that resulted from the presence of bees. A colony, he said, which has only 10,000 foragers should be considered as reaching barely average and a large stock housed in a big hive often has 80,000. Suppose 10,000 foragers go out four times a day, then in 100 days this will make four million sorties. And if each bee before returning home enters only twenty-five flowers, the bees of this hive will have visited 100 million flowers in the course of one year. It is no exaggeration to suppose that on ten of these flowers, at least one is fertilised by the action of the foragers and that the resulting gain would be only 1 centime for every 1,000 fertilisations. Yet in spite of these minimal estimates, it is evident that there is a benefit of £100 a year produced by the presence of just one hive. This mathematical conclusion is irrefutable. Certain fruit producers, above all viticulturists, set themselves up in opposition to bees because bees come and drink the sweet juices of fruit and grapes. But if we investigate the bee closely we soon notice that they ignore the intact fruits and only empty those with pellicles that are already perforated by birds or by the strong mandibles of wasps. The bee only gathers juice which, without it, would dry up and be wasted. It is totally impossible for bees to commit the theft they are accused of, because the masticatory parts of its mouth are not strong enough to enable it to perforate the fruit pellicle that protects the pulp.

2. The benefits of beekeeping.

I pity those who keep bees only to earn money. They deprive themselves of a very sweet enjoyment. However, money is necessary to live. Money is useful to those who like to spread happiness around themselves. Consequently it is justifiable to imagine that this could result from beekeeping. But reading certain books and certain periodicals may lead to error on this point.

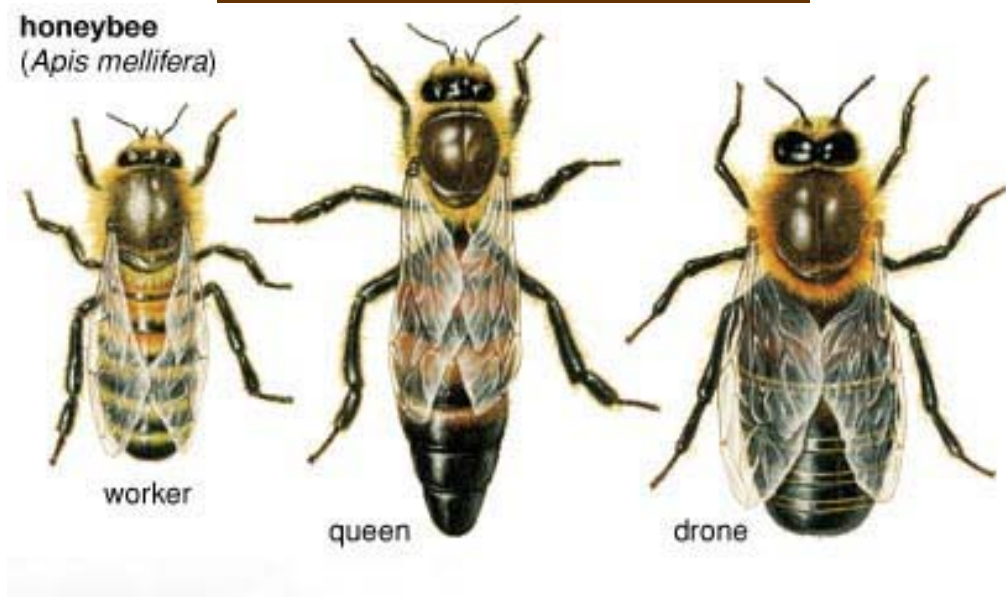
The lies

To encourage a return to the land or to deceive those who return there, beekeeper committees or some anti-beekeeping people published some staggering things in the newspapers. Perhaps there were also selfish beekeepers among them professing poor results so as not to create competition. Thus a prominent beekeeper claims that a harvest of only 10 kg is a rare maximum. At the other extreme, a professor asserts that honey harvests should average 100 kg per hive if rational beekeeping methods are adopted. A doctor declares that in America a single hive can yield an average annual harvest of 190 kg of honey, and that it is up to us to make it as much. Doubtless this would be by giving each hive 200 kg of sugar. But would not the fraud be exposed?

The truth

No type of hive, no method of beekeeping turns stones into honey. Neither do they make the beekeeper any wiser, or increase queen fertility or improve the ambient temperature. As a result the yield of a hive varies from one region to another, from one hive to another and from one year to another, just as does the nectar wealth of the region, queen fertility, temperature and the skill of the beekeeper.

3. Inhabitants of the Hive.



- **The Queen, Mother of all.**
- **Workers**
- **Drones**

The Queen, mother of them all and perfect female.



- The queen honey bee is the product of a fertilised egg, as are all females within the hive; however the queen receives a special diet throughout her larval life. That consists of Royal Jelly for the first 3 days of her life and a modified jelly thereafter, and it takes 16 days to produce a queen from an egg. The queen is the largest bee in the hive, due to her elongated abdomen (for egg laying). She is the sole source of replacement bees for the many that die daily from a variety of causes (old age, predation and disease) How many eggs she lays depends on a few things, being her age, health the amount of clean, empty cells within the hive, along with weather conditions. She will mate with a number of drones on her maiden flight (mating occurs outside the hive, and not in the hive.), and can store the sperm in her spermatheca to last her entire lifetime. Normally there is only 1 queen in a hive but there are on rare occasions exceptions to this rule. The queen usually lives for 3 years by which time she slows up laying and is replaced by the workers.
- The term **queen bee** is typically used to refer to an adult, mated female that lives in a honey bee colony or hive; she is usually the mother of most, if not all, the bees in the hive. The queens are developed from larvae selected by worker bees and specially fed in order to become sexually mature. There is normally only one adult, mated queen in a hive, in which case the bees will usually follow and fiercely protect her.
- The term "queen bee" can be more generally applied to any dominant reproductive female in a colony of eusocial bee species other than honey bees.
- When conditions are favourable for swarming, the queen will start laying eggs in queen cups. A virgin queen will develop from a fertilized egg. The young queen larva develops differently because it is more heavily fed royal jelly, a protein-rich secretion from glands on the heads of young workers. If not for being heavily fed royal jelly, the queen larva would have developed into a regular worker bee. All honey bee larvae are fed some royal jelly for the first few days after hatching but only queen larvae are fed on it exclusively. As a result of the difference in diet, the queen will develop into a sexually mature female, unlike the worker bees.

- Queens are raised in specially constructed queen cells. The fully constructed queen cells have a peanut-like shape and texture. Queen cells start out as queen cups. Queen cups are larger than the cells of normal brood comb and are oriented vertically instead of horizontally. Worker bees will only further build up the queen cup once the queen has laid an egg in a queen cup. In general, the old queen starts laying eggs into queen cups when conditions are right for swarming or supersedure. Swarm cells hang from the bottom of a frame while supersedure queens or emergency queens are generally raised in cells built out from the face of a frame.
- As the young queen larva pupates with her head down, the workers cap the queen cell with beeswax. When ready to emerge, the virgin queen will chew a circular cut around the cap of her cell. Often the cap swings open when most of the cut is made, so as to appear like a hinged lid.
- During swarming season, the old queen will likely leave with the prime swarm before the first virgin queen emerges from a queen cell.

Virgin Queen

A virgin queen is a queen bee that has not mated with a drone. Virgins are intermediate in size between workers and mated; laying queens, and are much more active than the latter. They are hard to spot while inspecting a frame, because they run across the comb, climbing over worker bees if necessary, and may even take flight if sufficiently disturbed. Virgin queens can often be found clinging to the walls or corners of a hive during inspections.

Virgin queens appear to have little queen pheromone and often do not appear to be recognized as queens by the workers. A virgin queen in her first few hours after emergence can be placed into the entrance of any queenless hive or nuc and acceptance is usually very good, whereas a mated queen is usually recognized as a stranger and runs a high risk of being killed by the older workers.

When a young virgin queen emerges from a queen cell, she will generally seek out virgin queen rivals and attempt to kill them. Virgin queens will quickly find and kill (by stinging) any other emerged virgin queen (or be dispatched themselves), as well as any unemerged queens. Queen cells that are opened on the side indicate that a virgin queen was likely killed by a rival virgin queen. When a colony remains in swarm mode after the prime swarm has left, the workers may prevent virgins from fighting and one or several virgins may go with after-swarms. Other virgins may stay behind with the remnant of the hive. As many as 21 virgin queens have been counted in a single large swarm. When the after-swarm settles into a new home, the virgins will then resume normal behaviour and fight to the death until only one remains. If the prime swarm has a virgin queen and the old queen, the old queen will usually be allowed to live. The old queen continues laying. Within a couple of weeks she will die a natural death and the former virgin, now mated, will take her place.

Unlike the worker bees, the queen's stinger is not barbed and is able to sting repeatedly without dying.

Metamorphosis of the queen bee	
Egg	hatches on Day 3
Larva (several moltings)	Day 3 to Day 8½
Queen cell capped	~ Day 7½
Pupa	~ Day 8 until emergence
Emergence	~Day 15½ - Day 17
Nuptial Flight(s)	~Day 20 - 24
Egg Laying	~Day 23 and up

Reproduction.

The surviving virgin queen will fly out on a sunny, warm day to a "drone congregation area" where she will mate with 12-15drones. If the weather holds, she may return to the drone congregation area for several days until she is fully mated. Mating occurs in flight. The young queen stores up to 6 million sperm from multiple drones in her spermatheca. She will selectively release sperm for the remaining 2–7 years of her life.

The young virgin queen has a limited time to mate. If she is unable to fly for several days because of bad weather and remains unmated, she will become a "drone layer." Drone-laying queens usually signal the death of the colony, because the workers have no fertilized (female) larvae from which to raise worker bees or a replacement queen.

Though timing can vary, mating's usually take place between the sixth and tenth day after the queen emerges. Egg laying usually begins 2 to 3 days after the queen returns to the beehive, but can start earlier than this.

A special, rare case of reproduction is thelytoky: the reproduction of female workers or queens by laying worker bees. Thelytoky occurs in the Cape bee, *Apis mellifera capensis*, and has been found in other strains at very low frequency.

Supersedure.

As the queen ages her pheromone output diminishes. A queen bee that becomes old, or is diseased or failing, will be replaced by the workers in a procedure known as "supersedure".

Supersedure may be forced by a beekeeper, for example by clipping off one of the queen's middle or posterior legs. This makes her unable to properly place her eggs at the bottom of the brood cell; the workers will detect this and will then rear replacement queens. When a new queen becomes available, the workers will kill the reigning queen by "balling" her, clustering tightly around her and stinging her. Balling is often a problem for beekeepers attempting to introduce a replacement queen.

If a queen suddenly dies, the workers will flood with royal jelly several cells where a larva has just emerged. The young larva floats on the royal jelly; the worker bees then build a larger queen cell from the normal-sized worker cell, which will protrude vertically from the face of the brood comb. Emergency queens are usually smaller and less prolific, and therefore not preferred by beekeepers.

Daily life of a queen.

Although the name might imply it, a queen does not directly control the hive. Her sole function is to serve as the reproducer. A well-mated and well-fed queen of quality stock can lay about 2,000 eggs per day during the spring build-up—more than her own bodyweight in eggs every day. She is continuously surrounded by worker bees who meet her every need, giving her food and disposing of her waste. The attendant workers also collect and then distribute queen mandibular pheromone, a pheromone that inhibits the workers from starting queen cells.

The queen bee is able to control the sex of the eggs she lays. The queen lays a fertilized (female) or unfertilized (male) egg according to the width of the cell. Drones are raised in cells that are significantly larger than the cells used for workers. The queen fertilizes the egg by selectively releasing sperm from her spermatheca as the egg passes through her oviduct.

Identification.

The queen bee's abdomen is noticeably longer than the worker bees surrounding her. Even so, in a hive of 60,000 to 80,000 honey bees, it is often difficult for beekeepers to find the queen with any speed; for this reason, many queens in non-feral colonies are marked with a light daub of paint on their thorax. The paint used does no harm to the queen and makes her much easier to find when necessary.

Although the colour is sometimes randomly chosen, professional queen breeders use a colour that identifies the year a queen hatched, which helps them to decide whether their queens are too old to maintain a strong hive and need to be replaced. Sometimes tiny convex disks marked with identification numbers ("opalithplattchen") are used when a beekeeper has many queens born in the same year. I prefer to replace the queen every year when doing a method of swarm control so not needing the different colours and just use white. This though is a matter of preference.



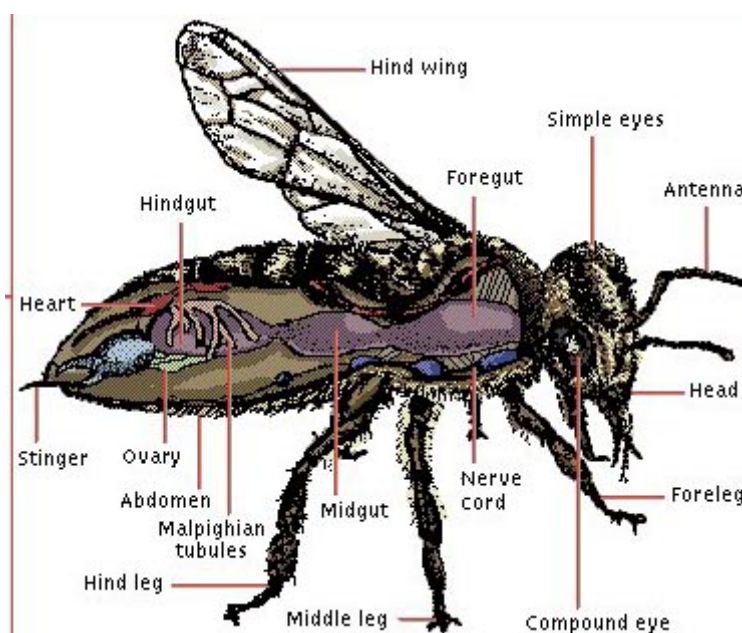
Queen marked yellow.

Colour		Year ends in
white		1 or 6
yellow		2 or 7
red		3 or 8
green		4 or 9
blue		5 or 0

Worker Bees, imperfect females.



- Worker bees are all females; they spend the first, two weeks of their lives taking care of brood, then shift jobs within the hive and spend the rest of their six to eight weeks life foraging for nectar, propolise and pollen. They, that are left in autumn can over winter in the hive. Worker bees are fed a larval diet which is deficient to that fed to the queen larva which results in the workers sex organs not being fully developed. There are times though when some workers may develop functioning ovaries and lay unfertilized eggs, which will normally result in drone bees (Male). This is a tell-tale sign of a queenless hive and must be watch for all the time.



A **worker bee** is any female (eusocial) bee that lacks the full reproductive capacity of the colony's queen bee; under most circumstances, this is correlated to an increase in certain non-reproductive activities relative to a queen, as well. Worker bees occur in many bee species other than honey bees, but this is by far the most familiar colloquial use of the term.

Workers gather pollen into the pollen baskets on their back legs, to carry back to the hive where it is used as food for the developing brood. Pollen carried on their bodies may be carried to another flower where a small portion can rub off onto the pistil, resulting in cross pollination. Almost all of civilization's food supply (maize is a noteworthy exception) depends greatly on crop pollination by honey bees, whether directly eaten or used as forage crops for animals that produce milk and meat. Nectar is sucked up through the proboscis, mixed with enzymes in the stomach, and carried back to the hive, where it is stored in wax cells and evaporated into honey.

Honey bee workers keep the hive temperature uniform in the critical brood area (where new bees are raised). Workers must maintain the hive's brood chamber at 34.4 °C to incubate the eggs. If it is too hot, they collect water and deposit it around the hive, then fan air through with their wings causing cooling by evaporation. If it is too cold, they cluster together to generate body heat. This is an example of homeostasis.

The life of all honey bees starts as an egg, which is laid by the queen in the bottom of a wax cell in the brood area of a hive. A worker egg hatches after three days into a larva. Nurse bees feed it royal jelly at first, then pollen and honey for six days. It then becomes an inactive pupa.

Honeycombs have hexagonal cells on both sides of a vertical central wall, these cells are inclined upward, primarily to retain liquid nectar and honey. During its 14 days as a pupa, sealed in a capped cell, it grows into a worker (female) bee, emerging on the 20th day. In most species of honey bees, workers do everything but lay eggs and mate, though Cape honey bee workers can lay eggs. They build the comb from wax extruded from glands under their abdomen. They clean, defend, and repair the hive. They feed the larva, the queen, and the drones. They gather nectar, pollen, water, and propolis. They ventilate, cool and heat the hive.

When a colony absconds (all the flying bees leave the colony) or divides and so creates a swarm and then establishes a new colony, the bees must regress in their behaviour in order to establish the first generation in the new home. The most urgent task will be the creation of new beeswax for comb. Beekeepers take advantage of this by introducing swarms into new or existing colonies where they will draw comb. Comb is much more difficult to come by than honey and requires about six times the energy to create. A newly hived swarm on bars (top bar hive) or empty foundation (Langstroth box hive) will often be fed sugar syrup, which they can then rapidly consume to create wax for new comb (Mature hives cannot be so fed as they will store it in place of nectar, although a wintering hive may have to be fed if insufficient honey was left by the beekeeper).

Tasks with in the hive for the worker

Cell cleaning (days 1–2)

Brood cells must be cleaned before the next use. Cells will be inspected by the queen and if unsatisfactory it will not be used. Worker bees in the cleaning phase will perform this cleaning. If the cells are not clean, the worker bee must do it again and again.

Nurse bee (days 3–11)

Nurse bees feed the worker larvae worker jelly which is secreted from glands that produce royal jelly.

Advanced Nurse Bees (days 6–11)

Feed royal jelly to the queen larva and drones receive worker jelly for 1 to 3 days at which time they are started on a diet of honey and pollen.

Wax production (days 12–17)

Wax bees build cells from wax, repair old cells, and store nectar and pollen brought in by other workers. Early in the worker's career she will exude wax from the space between several of her abdominal segments. Four sets of wax glands, situated inside the last four ventral segments of the abdomen, produce wax for comb construction.

Other worker activities up to day 22

Honey sealing

Mature honey, sufficiently dried, is sealed tightly with wax to prevent absorption of moisture from the air by workers deputized to do this.

Drone feeding

Drones do not feed themselves; they are fed by workers.

Queen attendants

The attendants groom and feed the queen. They also collect QMP (Queen Mandibular Pheromone) from the queen and share it with the bees around them who also share it spreading its effects through the hive.

Honeycomb building

Workers will take wax from wax producing workers and build the comb with it.

Pollen packing

Pollen brought into the hive for feeding the brood is also stored. It must be packed firmly into comb cells and mixed with a small amount of honey so that it will not spoil. Unlike honey, which does not support bacterial life, stored pollen will become rancid without proper care. It has to be kept in honey cells.

Propolizing

The walls of the hive are covered with a thin coating of propolis, a resinous substance obtained from plants. In combination with enzymes added by the worker this has antibacterial and antifungal properties. Propolis is used to aide with ventilation and at the entrances of hives.

Mortuary bees

Dead bees and failed larvae must be removed from the hive to prevent disease and allow cells to be reused. They will be carried some distance from the hive by mortuary bees.

Fanning bees

Worker bees fan the hive, cooling it with evaporated water brought by water carriers. They direct airflow into the hive or out of the hive depending on need.

Water carriers

When the hive is in danger of overheating, these bees will obtain water, usually from within a short distance from the hive and bring it back to spread on the backs of fanning bees. The worker bee has a crop separate from the nectar crop for this purpose.

Foraging bees (days 22–42)

The forager and scout bees travel (up to 3 miles) to a nectar source, pollen source or to collect propolis.

General Characteristics.

In most common bee species, worker bees are infertile due to enforced altruistic kin selection, and thus never reproduce. Workers are nevertheless considered female for anatomical and genetic reasons. Genetically, a worker bee does not differ from a queen bee and can even become a laying worker bee, but in most species will produce only male (drone) offspring. Whether a larva becomes a worker or a queen depends on the kind of food it is given after the first three days of its larval form.

The worker bee's stinger is a complex organ that allows a bee to defend itself and the hive from most mammals. Attacking bees aim for the face by sensing regions with high levels of carbon dioxide (like mosquitos). Bee stings against mammals and birds typically leave the stinger embedded in the victim due to the structure of flesh and the stinger's barbs. In this case, the venom bulb stays with the stinger and continues to pump. Upon losing its stinger, the bee will subsequently die since the portion where the stinger bulb was removed rips out part of its insides.

The barbs on the stinger will not catch on most animals besides mammals and birds. This means that such animals can be stung many times by the same bee.

Drones (Male Bees)



- Drones are the male bees and have no father (being the product of an unfertile egg). They are much specialised in the fact they have, unlike the worker, no stinger and are defenceless. They do not forage and in the early stages of their lives are fed by

the workers. They have very large eyes and antenna, specially adapted to find the queen on her maiden flight. Their sole purpose in life is to mate virgin queen and if successful their reward is death as they rip out their genitals on mating. In areas where they have pronged winters they are evicted from the hive and left to die.

Drones carry only one type of allele because they are haploid (containing only one set of chromosomes from the mother). During the queen's egg developing process, a diploid cell with 32 chromosomes divides to generate haploid cells called gametes with 16 chromosomes. The result is a haploid egg, with chromosomes having a new combination of alleles at the various loci. This process is also called arrhenotokous parthenogenesis or simply arrhenotoky.

There is much debate and controversy in the scientific literature about the dynamics and apparent benefit of the combined forms of reproduction in honey bees and other social insects, known as the haplodiploid sex-determination system. The drones have two reproductive functions. They convert and extend the queen's single unfertilized egg into about 10 million genetically identical male sperm cells. Secondly, they serve as a vehicle to mate with a new queen to fertilize her eggs. Female worker bees develop from fertilized eggs and are diploid in origin, which means that the sperm from a father provides a second set of 16 chromosomes for a total of 32—one set from each parent. Since all the sperm cells produced by a particular drone are genetically identical, sisters are more closely related than full sisters of other animals where the sperm is not genetically identical.

In honey bees, the genetics of offspring can best be controlled by artificially inseminating a queen with drones collected from a single hive, where the drones' mother is known. In the natural mating process, queen mates with multiple drones, which may not come from the same hive. Therefore, in the natural mating process, batches of female offspring will have fathers of a completely different genetic origin.

Description.

Drones are characterized by eyes that are twice the size of those of worker bees and queens, and a body size greater than that of worker bees, though usually smaller than the queen bee. Their abdomen is stouter than the abdomen of workers or queen. Although heavy bodied, drones must be able to fly fast enough to accompany the queen in flight.

Development.

Type	Egg	Larva	Cell capped	Pupa	Developmental Period	Start of Fertility	Size	Hatching Weight
Drone	3 days	6½ days	10 days	14½ days	24 days	approx. 38 days	15–17 mm	nearly 200 mg

The role of the Drone.

The drones' main function is to be ready to fertilize a receptive queen. Drones in a hive do not usually mate with a virgin queen of the same hive because they drift from hive to hive. Mating generally takes place in or near drone congregation areas. It is poorly understood how these areas are selected, but they do exist. When a drone mates with his sister, the resultant queen will have a spotty brood pattern (numerous empty cells on a brood frame). This is due to the removal of diploid drone larvae by nurse bees (i.e., a fertilized egg with two identical sex genes will develop into a drone instead of a worker).



Drone in Flight

Mating occurs in flight, which accounts for the need of the drone's better vision, which is provided by their large eyes. Should a drone succeed in mating he soon dies because the penis and associated abdominal tissues are ripped from the drone's body after sexual intercourse?

Honey bee queen breeders may breed drones to be used for artificial insemination or open mating. A queen mating yard must have many drones to be successful.

In areas with severe winters, all drones are driven out of the hive in the autumn. A colony begins to rear drones in spring and drone population reaches its peak coinciding with the swarm season in late spring and early summer. The life expectancy of a drone is about 90 days.

Behaviour.

Drones do not exhibit typical worker bee behaviours such as nectar and pollen gathering, nursing, or hive construction. While drones are unable to sting, if picked up they may swing their tails in an attempt to frighten the disturber. Although the drone is highly specialized to perform one function, mating and continuing the propagation of the hive, it is not completely without side benefit to the hive. All bees, when they sense the hive's temperature deviating from proper limits, either generate heat by shivering, or exhaust heat by moving air with their wings—behaviours which drones share with worker bees. In some species drones will buzz around intruders in an attempt to disorient them if the nest is disturbed.

Drones fly in abundance in the early afternoon and are known to congregate in drone congregation areas a good distance away from the hive.

Mating and sexual behaviour.

The drone penis is designed to disperse a large quantity of seminal fluid and spermatozoa with great speed and force. The penis is held internally in the drone (an endophallus). During mating, the organ is everted (turned inside out), into the queen. The eversion of the penis is achieved by contracting abdominal muscles, which increases hemolymph pressure, effectively "inflating" the penis. Claspers at the base of the penis help to grip the queen. Mating between a single drone and the queen lasts less than 5 seconds, and it is often completed within 1-2 seconds. Mating occurs mid-flight, and 10-40m above ground. Since the queen mates with 12 ± 7 drones, and drones die post-mating, each drone must make the most of his single shot. The drone makes first contact from above the queen, his thorax above her abdomen, straddling her. He then grasps her with all six legs, and everts the endophallus into her opened sting chamber. If the queen's sting chamber is not fully opened, mating is unsuccessful, so some males that mount the queen do not transfer semen. Once the endophallus has been everted, the drone is paralyzed, flipping backwards as he ejaculates. The process of ejaculation is explosive—semen is blasted through the queen's sting chamber and into the oviduct. The process is sometimes audible to the human ear, akin to a "popping" sound. The ejaculation is so powerful that it ruptures the endophallus, disconnecting the drone from the queen. The bulb of the endophallus is broken off inside of the queen during mating—so drones only mate once, and die shortly after. The leftover penis remaining in the queen's vagina is referred to as the "mating sign". The plug will not prevent the next drone from mating with the same queen, but may prevent semen from flowing out of the vagina.



The everted penis, with the cornua in focus, containing sperm is in focus



The extended bulb of the penis, Resembling hooks.

Drone congregation areas.

Mating between the drones and a virgin queen takes place away from the colony, in mid-air mating sites. These mating sites, called 'congregation areas', are specific locations, where drones wait for the arrival of virgin queens to mate with. A congregation area is typically 10-40 meters above ground, and can have a diameter of 30-200 meters. The boundaries of a congregation area are distinct, queens flying a few meters outside the boundaries are mostly ignored by the drones. Congregation areas are typically used year after year, with some spots showing little change over 12 years. Since drones are expelled from a colony during the winter,

and new drones are raised each spring, inexperienced drones must find these congregation areas anew. This suggests that there are some environmental cues that define a congregation area, although the actual cues are unknown. Congregation areas are typically located above open ground, away from trees or hills, where flight is somewhat protected from the wind (calm winds may be helpful during mating flight). At the same time, many congregation areas do not show such characteristics, such as those located above water or the forest canopy. Some studies have suggested that magnetic orientation could play a role, since drones older than 6 days contain cells in the abdomen that are rich in magnetite.

Congregation areas can be located by attaching a virgin queen (in a cage) to a balloon floating above ground. The person then moves around, taking note of where drones are attracted to the caged queen. Congregation areas are not found closer than 90m from an apiary, and congregation areas located further away from apiaries receive more drones. In a congregation area, drones accumulate from as many as 200 colonies, with estimates of up to 25,000 individual drones. This broad mixing of drones is how a virgin queen can ensure she will receive the genetic diversity needed for her colony. By flying to congregation areas further away from her colony, she further increases the probability of outbreeding. A single drone will visit multiple congregation areas during his lifetime, often taking multiple trips per afternoon. A drone's mating flight averages 25-32 minutes, but can last up to 60 minutes, before he must return to the colony to refuel with honey. While at the site, the drones fly around passively, waiting for the arrival of a virgin. When the virgin queen arrives to the congregation area, the drones locate her by visual and olfactory cues. At this point, it's a race to mate with the virgin queen, to be genetically represented in the newly founded colony. The swarming drones, as they actively follow the queen, reportedly resemble a "drone comet", dissolving and reforming as the drones chase the virgin queen. Drones greatly outnumber the quantity of virgin queens produced per season, so even with multiple mating by the queen; very few drones will successfully mate (estimated at less than 1 in 1000). If needed, a virgin queen can embark on multiple 'nuptial flights', to be sure to receive enough semen from enough drones.

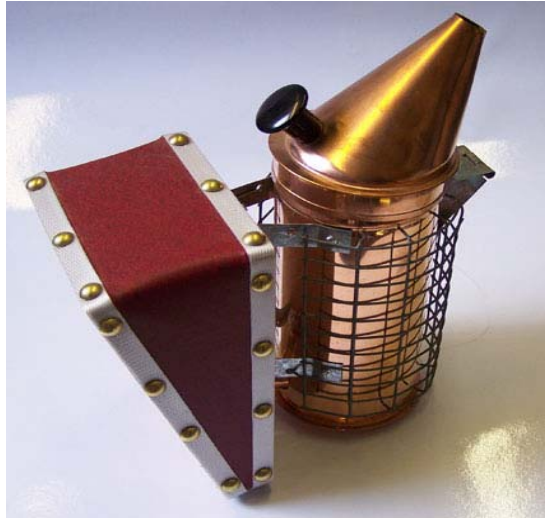
And in conclusion.

So there you have the 3 types of bees in the hive. A lot of information about them but its well worth learning. Many beekeepers tend not to bother about this side of beekeeping as it's too technical, I on the other hand find it fascinating and would advise any new beekeeper to have a look and try to at least get to grips with the basics of the hive inhabitants; you will find it well worth the effort.

In the next chapter we will look at what equipment we need to safely, and with confidence, handle your bees.

4. The equipment you will need.

The Smoker.



The fact that smoke calms bees has been known since ancient times; however, the scientific explanation was unknown until the 20th century and is still not fully understood. Smoke masks alarm pheromones (which include various chemicals, that are released by guard bees or bees that are injured during a beekeeper's inspection. The smoke creates an opportunity for the beekeeper to open the beehive and work while the colony's defensive response is interrupted. In addition, smoke initiates a feeding response in anticipation of possible hive abandonment due to fire. When a bee consumes honey the bee's abdomen distends, making it difficult to make the necessary flexes to sting. (The latter has always been the primary explanation of the smoker's effect, since this behaviour of bees is easily observable.)

Smoke is of limited use with a swarm, partly because swarms have no honey stores to feed on. It is usually not needed, either, since swarms tend to be less defensive as they have no home to defend, and a fresh swarm will have fed well at the hive it left behind. Smokers have been used in beekeeping for millennia, beginning perhaps with just a smouldering stick or a simple pan for burning. Beekeepers also used various bellows as originally employed by smiths or other workers.

Moses Quinby, the first commercial beekeeper in the United States, is credited with the invention of the modern single-handheld smoker (1875), with a bellows attached to a tin burner. Encyclopædia Britannica mentions T. F. Bingham of Farwell, Michigan, USA as the inventor of the smoker "most used in America and in the United Kingdom." His design was based on that of Quinby.

Many types of fuel can be used in a smoker as long as they are natural and uncontaminated with harmful substances. These fuels include hessian, burlap, pine needles, corrugated cardboard, paper egg cartons, and rotten or punkie wood. Some beekeeping supply sources also sell commercial fuels like pulped paper and compressed cotton.

The fuel in the smoker's burner smoulders slowly because there is only a small amount of oxygen inside, until a squeeze of the bellows provides a blast of fresh air. In this way the fuel is used more sparingly than in an open pan, and one load of fuel may last for several hours or even days (if it is extinguished and rekindled again later).

There is a great variety of modifications to the basic design. There is often an inner can for easy loading and cleaning, with numerous holes in the walls for air penetration. Some smokers have an outer grid attached, as a safety guard against burns.

The Protective Clothing.



While knowledge of the bees is the first line of defence, most beekeepers also wear some protective clothing. Novice beekeepers usually wear gloves and a hooded suit or hat and veil. Experienced beekeepers sometimes elect not to use gloves because they inhibit delicate manipulations. The face and neck are the most important areas to protect, so most beekeepers will at least wear a veil.

It's worth noting that no amount of protective clothing will make the experience of a face-full of aggressive bees flying up from an opened hive pleasant for any beekeeper, and so it's rewarding to colonise kindly bees as soon as possible.

Defensive bees are attracted to the breath, and a sting on the face can lead to much more pain and swelling than a sting elsewhere, while a sting on a bare hand can usually be quickly removed by fingernail scrape to reduce the amount of venom injected.

The protective clothing is generally light coloured (but not colourful) and of a smooth material. This provides the maximum differentiation from the colony's natural predators (bears, skunks, etc.) which tend to be dark-coloured and furry.

The 'stings' retained in the fabric of the clothing will continue to pump out an alarm pheromone that actually attracts aggressive action and further stinging attacks. Washing suits regularly and rinsing gloved hands in vinegar will minimise attraction.

The Hive Tool.



A Good Hive tool is an essential piece of equipment. Used mostly every time you enter the beehive, it's best to invest in a good one, being heavy duty, which will last you a lifetime?

- Its uses are for getting into the hive by removing the crown board, when stuck up with propolis.
- Manipulation and lifting out of the brood and super frames.
- Scraping off propolis and general cleaning up.

The hive tool should always be kept in your pocket or where you can get at it easily.

Uncapping Fork.



The Uncapping fork has many uses, such as:

- Uncapping drone brood for the inspection of Varroa Mites.
- Uncapping wax from honey supers prior to extracting the honey crop.

The simple uncapping fork is still a very effective way of uncapping combs of honey. The cranked needles on the model shown above keep the handle away from the face of the comb and allow the beekeeper to lift off the capping with minimum wastage. Although many beekeepers use a knife for uncapping, a knife produces a lot of wax and honey which have to be separated somehow. Commercial bee farmers use expensive capping's spinners but used

carefully, the uncapping fork produces almost dry wax with only a little honey mixed in with it. This makes the uncapping fork an ideal tool for the small scale beekeeper with only a few hives. Easy to use and with minimal wastage of honey.

The uncapping fork is also used for removing drone comb as part of Varroa control. This tool is ideal for that purpose but please don't use the same tool for uncapping and drone brood removal as this could lead to contamination of your honey.

Marking Pens.



The marking pen is used mostly for marking the queen.

You need at all times to know where your queen is, and when the hive is full, say in summer she can be difficult to spot as the hive will be full of bees, so having her marked will make the job of finding her so much easier.

Should be perfect for marking your new queen for easy detection, also determines how old your queen is by the colour.

Next year's queens are universally recognised as having the colour YELLOW dotted on the top of her back.

It is easy to apply, but you will need to catch your queen and hold her still!!

The five internationally recognised colours are -

- Year ending with a 1 or 6 = White
- Year ending with a 2 or 7 = Yellow
- Year ending with a 3 or 8 = Red
- Year ending with a 4 or 9 = Green
- Year ending with a 5 or 0 = Blue

If you use, say for example, the curry method of swarm control and replace the queen every year, you will use only a white colour as you know that the queen is only a year old.

Drawing Pins.



- Drawing Pins are used to mark the position of where you have carried out some work deep in the hive and where you cannot see after you have put the frame or frames back into the hive.
- You put the drawing pin into the top of the frame, above where you have carried out the manipulation.
-

Magnifying Glass.



- An invaluable piece of equipment which is:
- Used to check your Varroa inserts for the presence of Varroa.
- For looking at floor scrapings.
- For looking at Pollen.
- To check for bee abnormalities.
- General looking at things that are hard to look at with the naked eye.

Gubbings Box/ Tool Box.



When you have obtained all the equipment you need you will need somewhere to put it all. A Gubbings box or any tool box will do but it should have the following.

- A place for your Smoker.
- A place for your Hive Tool.
- A place for your Lighter/ Blowlamp.
- Places for your Hive Cloths.
- Places for your Queen Cage and Markers, Drawing Pins Etc.
- Places for your rubbish and collected wax etc.
- It is surprising how much storage you will need, for such as Scissors, Secateurs, Marking Pens, Magnifying Glass, Small Tube of Icing Sugar.
- In fact anything that you need on the job.

Porter Bee Escape.



These fit into your crown board just before you are ready to remove your honey from the supers. The bees can leave the supers however, they cannot return. Hence your supers should be vacated ready for you to steel their hard earned nectar. It can save a lot of stress all round! They can also be left in the crown board all the time as it helps to keep robbing bees out of the hive.

Queen Marking Cage.



A round marking cage known as the “Crown of Thorns” or Baldock cage, is a very useful piece of equipment also, but is very easy to lose and again it is better to have a red flag tied to it with a piece of string. The circle of spikes should be stuck into a square of polystyrene to prevent them from sticking into people's knees etc.

Used to hold the Queen on the comb whilst she is marked, and remember, the Queen must be marked or you will have difficulties in finding her when it comes to carrying out your swarm control or other manoeuvres which involve finding the Queen. Once you are experienced at handling your queen you can disregard and use your fingers.

Hive Cloths.



Hive cloths are used in pairs. If you are working the bees deep in the hive and for over a long period, they can get a little angry with you and fly up and make the work you are carrying out harder than it should be.

This is where your hive cloths come into use and can save you lots of time and maybe lots of stings.

Mouse Guards.



Most often, mouse guards are used prior to the onset and during the winter months to prevent mice from choosing a beehive as a hibernation spot. It is also not uncommon for mouse guards to be used year round in some areas to help in the control of pests. Mouse guards are often designed to be nailed or stapled across the entrance of a hive, between the bottom board and the lower hive body.

Brush or Goose Feather.

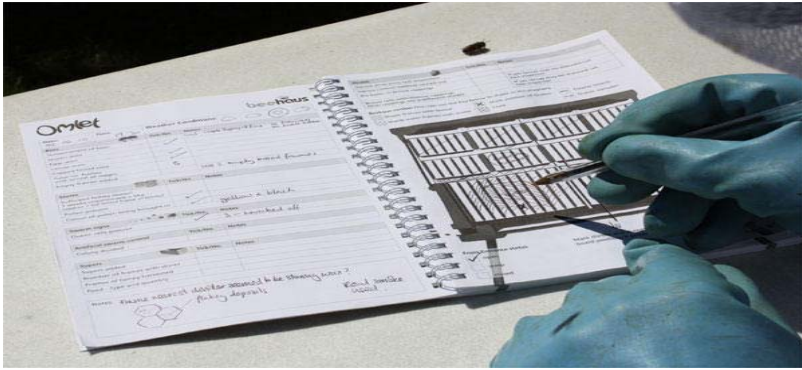


This soft bristled bee brush is ideal for both clearing bees from super frames and brushing bees from the edges of the hive bodies to reduce the danger of crushing.

When clearing bees from super frames have an empty super on the ground next to the hive with a cover or roof fitted to it. Lift out each frame from the super to be cleared in turn and first shake the bees from the frame then brush off the stragglers with the brush. Always brushing and shaking the bees back into the hive. When all the bees are off the frame place it quickly into the empty super and replace the cover. When all frames have been cleared of bees take the super away but do not take it directly to your extraction room. Stop a short distance from the room and go through the super again, brushing off any remaining bees which nipped into the super when you were adding frames. When you do take the super to the extraction room ensure the windows are closed to stop bees coming in. If there are any bees still in the super they will fly towards the windows, if necessary turn off any lights in the room to encourage them to do this. You can open the windows briefly to let out the bees but close them quickly as the smell of honey during extraction is a powerful attractant for any bees in the area!

To reduce the risk of disease transmission wash the brush regularly. A dish washer on a cool cycle works fine but ensure the brush is lying flat so the bristles stay straight. If the bristles do get a kink they will straighten out after a short while.

Record Book.



- There are various designs of record card available, and with the aid of a computer, it is easy to design your own. If record keeping is to be successful, it is important that the records hold the required information and they are quick and easy to complete.
- When considering what to record, a good starting point are the 5 questions asked by Ted Hooper in his classic book "A Guide to Bees and Honey". These are:
 - 1) Room - has the colony enough?
 - 2) Queen - is the queen present? Are there any signs of swarm preparation?
 - 3) Development - how many frames of brood are there?
 - 4) Disease - are there any signs?
 - 5) Stores - has the colony enough stores to survive to the next inspection?

Additional equipment such as Scissors and Mesh Etc.



There are always uses for additional equipment and are handy to be kept in your Gubbings Box. It all depends on what you are doing at the time but a useful list is as follows.

- Scissors for queen clipping, cutting up Hessian or Cardboard for your smoker, cutting string if things need to be tied down etc.
- Mesh for covering up the porter bee escapes and other holes during certain manipulations.
- A pair of secateurs in case you get a swarm and need to cut off a small branch to get the swarm into a box.

- A small box to put in any surplus beeswax you may have for recycling.
- String for tying things up.
- Any other odds and sods you may need for your own situation.
- Matches to light your smoker.

In conclusion.

Always keep your equipment in good order and replace any that are broken. If anything gets lost, replace it right away. There is nothing worse than going into you bees and not having, say a queen marking cage, having to go a find one, only to have lost the queen deep in the hive. Protective clothing with holes in the veil, dangerous for obvious reasons. Protective clothing, not washed, will attract guard bees because of the pheromone smell left on them, along with you looking like a lazy beekeepers if someone comes to visit you.

So there you have the equipment to need. We will therefore now take a look at parts of the hive.

5. Parts of the Hive.

- **Stand**
- **Varroa Floor.**
- **Brood Box.**
- **The Entrance Block.**
- **Brood Frames.**
- **Dummy Frames**
- **Queen Excluder.**
- **Honey Super.**
- **Honey Super Frames.**
- **Crown Board.**
- **Porter Bee escapes.**
- **Roof.**

Stand



- A hive stand is used to keep the hive away and off the ground. The reasons are to keep out unwanted pest such as snails, ants etc.
- To give the hive ventilation.
- To create a comfortable working environment, with not too much bending down.
- When used with open mesh floors the debris can fall on the ground so keeping the hive free from rubbish etc. and let any Varroa fall to and not return into the hive.

Varroa Floor.



An essential part of any hive and a must have piece of equipment for any Beekeeper whether a beginner or experienced Beekeeper.

With the Varroa mite now being the biggest problem for the Beekeeper. You must learn to regularly estimate the level of infestation throughout each season. Infestation will build up more quickly in some years than in others and more quickly in some apiaries than others. A control programme that was effective one year will not always be effective in another.

Monitoring your colonies routinely can tell you how mite infestation is developing. You can then use this information to decide what and when control methods will be appropriate. To carry out the monitoring you must count the natural mite fall, and this can only be done with the use of the Varroa Drawer/Open Mesh Floor. At this stage of the course I will not go into too much detail as it will be covered in greater detail at a later stage. But will only say that this is a very important part of a beekeepers equipment.

Brood Box.



Also known as a brood chamber, this is the box that the bees raise their young in. It is called a brood chamber or brood box for this reason. It is properly known as the 'British Standard Deep Box'.

It is also called a 'deep' or 'deep box' and confusingly it can be known as a 'deep super' if it is used for honey gathering.

Use for raising brood is most prevalent. However in the USA it is common for all boxes to be 'deeps' for interchangeability. In the UK we adopt shallow boxes for honey and deep ones for brood to avoid breeding occurring in frames that are to be extracted from.

The Entrance Block.



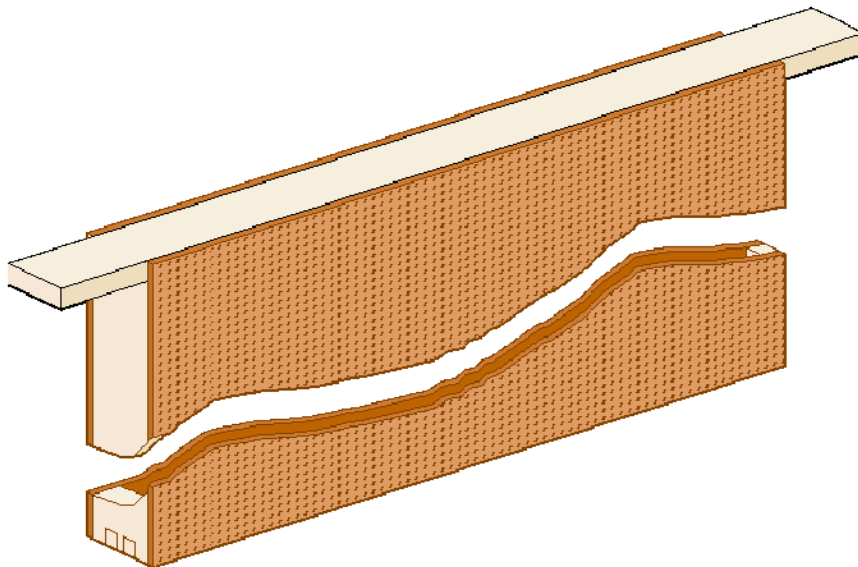
- Entrance reducers may be used to protect a weak hive from invasion by robbing honey bees or wasps. A hive with insufficient numbers of bees may find it difficult to defend a large opening. A smaller opening gives them a fighting chance.
- Entrance blocks are often used in the winter to reduce drafts through the hive, to keep snow and rain from entering, and to discourage small mammals—such as mice—from entering.
- Entrance blocks may be used during treatments with essential oils or organic acids. These treatments—which are alternatives to regular pesticides—are used to control mites. To use them, the beekeeper must make the hive into a fumigation chamber which will contain the compounds. Reducing the entrance is one of several steps that allow these alternative treatments to work.

Brood Frames.



- The brood frame is where all the work in the hive is carried out by the bees.
- It's where the brood in all stages are, from egg to emerging bees.
- It's where the queen spends her life and the only place where she lays her 2000 eggs per day.
- All nectar is brought here and also pollen and the only surplus there is, is put above in the supers.

Dummy Frames.



Dummy Frames are excellent for controlling an expanding swarm or a weak colony. Put the boards in spring when the colony is weak from over wintering and as the brood expands, take them out.

Are used to reduce the need to fill the brood chamber with fresh foundation so preventing a swarm building wild comb, or trashing the foundation to build comb elsewhere.

Queen Excluder.



Used solely to keep the Queen in the Bottom Brood Chamber, the Queen Excluder is placed the on the top of the Brood Box.

Queen Excluders comes in a few different styles from expensive metal ones to cheaper plastic type. All work the same, with it being a matter of choice and expense on the one chosen.

Honey Super.



The super goes on top of the Brood Chamber. It is separated from the Brood Chamber by a Queen Excluder so that only Honey is in the Super and no Brood etc.

Honey Super Frames.



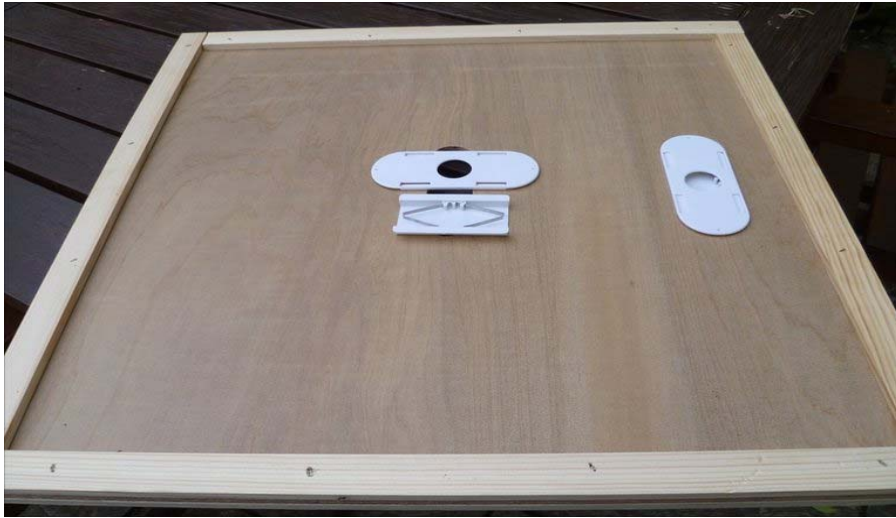
The Super Frames, with foundation are where the surplus honey is stored and what we extract when full of honey that has been capped over with wax by the bees.

Crown Board.



Usually has two cut out slots for two plastic Porter Bee Escapes, This board provides good insulation when in its usual position above the top super and below the roof. It is also used when clearing the bees with porter escapes. When feeding bees, the feed is placed directly over one of the slots if using a rapid feeder, or both slots if using a bucket contact feeder. In the winter, the Crown Board is often placed directly over the brood body.

Porter Bee escapes.



Invented in the USA by Mr. Porter in 1891. The basic principle of its use is simplicity itself - a one way valve. Place the escapes in the crown board slot/s with the top hole uppermost. Check that the stainless steel springs are 3mm apart. This supplies just enough tension for the bees to pass through yet are close enough together to prevent their return. Remove the queen excluder and put the crown board in its place below the super/s to be cleared. Bees leave the super, pass through the 22mm diameter hole and into the chamber of the escape. Once there the bees have two escape routes through the springs. If used properly, bees should clear supers over a 12 hour period.

Roof.



Bees never die from being too cold, but they do die because they get wet and damp, therefore a good waterproof roof is important especially in the winter months when the bees are dormant and cannot fan away any excess moisture from the hive.

Beehives are very expensive and need to be kept in good condition so as to avoid having to replace them. Also a dirty looking beehive reflects how untidy a beekeeper you are. Try to make some parts yourself so as to save you some money and it is also very satisfying to know you have made it yourself. So there you have the complete beehive. All ready to receive you bees. Firstly though I would like to explain a little about the biology of your bees.



Honey Bee Life Cycle Stage Two.

The Worker.

The Drone.

The Queen.

The colony through the year

Bee Egg Development.

The Honey Bee Inside out.

Origin of the 3 types of Bee

Division of Labour.

Swarming.

Our part in Beekeeping.

Honey Bee Life Cycle Stage One

- Life Cycle of the Honeybee (Apis mellifera)
- A colony of honeybees at the height of the summer contains 50,000 bees. There is one queen (female) capable of laying 2,000 eggs per day, several hundred drones (males), and the rest workers (sterile females).
- Both the workers and the queen develop from fertilised eggs (egg + sperm) and have 32 chromosomes. The queen is reared in a queen cell and receives a richer and more plentiful diet (royal jelly or brood food). The workers are all potential queens, it is the feeding that makes the difference (workers have rudimentary ovaries and may become laying workers producing drones).
- The drones develop from unfertilised eggs and have 16 chromosomes. A drone has a mother but does not have a father - but he does have a Grandmother and a Grandfather!

- Stages in Life Cycle.

<u>Open Cell:</u>	<u>Drone</u>	<u>Worker</u>	<u>Queen</u>
• Egg Days	3 Days	3 Days	3
• Larva (4 moults) Days	5 days	5 Days	5
• Total Days	8 Days	8 Days	10
• <u>Sealed Cell:</u>			
• Larva/Pro-pupa (1 moult) days	3 days	2 days	4
• Pupa (1 moult) days	10 days	6 days	10
• <u>From egg to emergence:</u>			
• Total days	21 days	16 days	24
• <u>Life after emergence:</u>			
• <u>Summer bee</u>	Worker 6 weeks	Queen 3 years	.
• <u>Drone 4 months*</u>			
• <u>Winter bee</u>	6 months.		
• This relates to the bees that hatched out late in the season, usually the old summer bees die off first leaving the late hatched ones to over winter.			
• *Drones that mate die - drones are killed by the workers in the autumn.			

Development of the worker.

Day 1.

Queen measures size of cell to determine whether it is a drone or a worker cell.

Egg vertical, parallel to cell walls.

Day 2.

Egg at 45 deg.

Day 3.

Egg horizontal, lying on the bottom of the cell - hatches.

Day 4 - 8.

Larva fed by workers, grows, moults every 24 hours, eventually fills cell - cell sealed.

Day 8 - 21.

Excretes. Stretches head outwards and spins a cocoon - pupa develops after 5th moult (3 days after sealing) - colour slowly changes from white. 6th moult occurs just before emergence.

Functions of the worker

Day 1 - 3. Cell cleaning & brood incubation.

Day 4 - 6. Feeding older larvae (honey + pollen).

Day 7 - 12. Feeding young larvae (brood food).

Day 13 - 18. Processing nectar into honey (water evaporation), wax making, pollen packing.

Day 19 - 21. Guarding and orientation flights.

Day 21 - 6th week. Foraging for nectar, pollen, water & propolis.

Bees often do nothing! Duties depend on the maturity of the brood glands, wax glands at (day 12) & sting gland at (day 18) - bees can revert to earlier duties if required. Other duties included ventilation, humidity and temperature control.

Honey Bee Life Cycle: The Drone and Queen

Functions of the Drone

- Up to around day 12. Confined to hive except for cleansing & orientation flights on fine days.
- Day 12 - 14. Sexually mature. Drones meet (20 deg. /afternoon) in congregation areas - drone assemblies. Drones are attracted to virgin queens by pheromones.
- Autumn. Massacre of the drones. The drone's sole function is to mate with virgin queens (from which act he dies). Drones still alive in the autumn are no longer required and are removed from the hive where they or nor readmitted or killed.

Functions of the Queen

- Day 1. On hatching, may kill sealed queens (may swarm).
- Day 3 - 5. Orientation flights.
- Week 1 - 3. Mating flights. Very Important to look out for
- Year 3 - 5. Starts laying 2 - 4 days after mating. Produces pheromones (chemical messengers) that inform the colony of her presence & inhibits queen raising. If the queen dies (or is removed) or is old, the workers can produce queens from fertilised eggs. Queens are produced when the colony swarms.

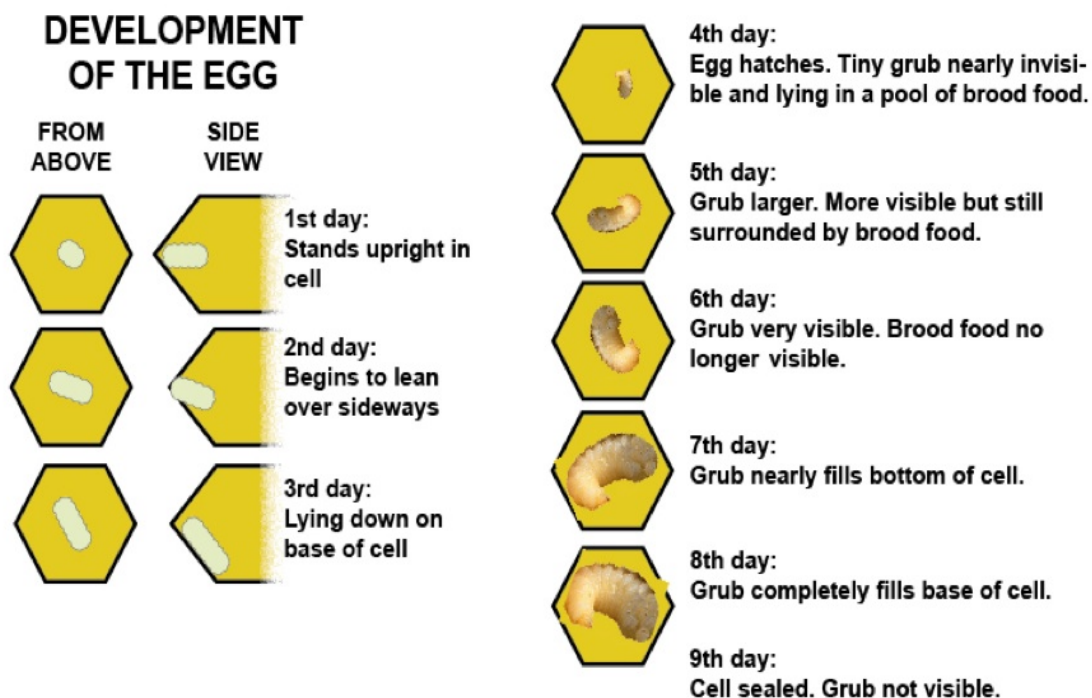
The colony through the year.

- During the winter the colony clusters and becomes inactive - egg laying ceases and food consumption is low. In the spring, as it gets warmer and day length increases, the queen starts laying - the cluster breaks and stores are consumed. The bees take cleansing flights and seek water and pollen from early flowers (crocus etc.). The population decreases as the old bees die. The decrease in population and stores needs to be balanced by new bees and incoming pollen and nectar. Disease, poor weather, lack of forage and too few bees can cause a delay in development. Colonies need to be strong enough to take advantage of early nectar/pollen in April.
- As the season progresses, drones are produced in readiness for swarming. The population increases until the brood box is full and extra space has to be provided - supers are added.
- The colony is held together by the queen's pheromones, which are passed around the hive by grooming and food sharing. When the population is large, the effect of the pheromones is diluted and the inhibition to produce queens is reduced - the colony may swarm (usually April, May, and June). Swarming is reproduction - and survival. The old queen leaves with half the colony (**All the flying bees i.e. Honey gatherers, so honey production is lost until the house bees which are left start to which could be up to a month**). A virgin queen hatches from one of several queen cells prepared before swarming. She kills the other queens in their cells or swarms with the flying bees being half of the remaining colony - this can occur several times unless the beekeeper takes action. The swarm finds a new location (or is hived). The virgin queen in the original colony mates on the wing (30'-90' above the ground) with several drones and returns to the hive to commence her egg laying. Egg laying is often erratic when the queen starts laying and more than one egg per cell occurs - this phenomenon soon disappears.
- Supersedure is the replacement of the queen without swarming – both mother and daughter may co-exist for a time.
- The mated queen can lay an egg, which becomes a drone, or add sperm to the egg to produce a worker - if the fertilised egg is reared in a queen cell and fed copiously, a queen is produced. The queen determines the type of cell by measuring with her front legs - worker cells are smaller than drone cells. The workers decide if a queen cell is required. The balance of drones and workers is determined by colony needs. If the queen dies or is failing (old age or insufficient mating), the workers can produce a replacement queen if they have fertilised eggs present.
- If a queen and her pheromones are not present, the workers rudimentary ovaries may function producing drone laying workers. Since workers have not mated, they can only lay unfertilised eggs producing drones. Laying workers produce small drones in worker cells (raised domes) in a haphazard pattern - the queen lays in a compact & orderly pattern - usually more than one egg per cell.
- Bees produced in the summer work for 3 weeks in the hive and then work themselves to death during the next 3 weeks collecting nectar, pollen, water and propolis. Sufficient honey has to be produced for their daily needs and for winter stores - in a good year there will be a surplus for the beekeeper. In a bad year it may be necessary to feed a colony. Winter bees have fat layers and will survive through the winter. In the autumn the drones are evicted, and the colony gradually forms a cluster and the cycle continues.
- There are 20,000 species of bees in the world. Only honeybees survive the winter as a colony - wasps and bumblebees rear queens to overwinter and the

colonies die. The survival & progress of the colony depends on several factors: climate/forage, disease, genetics (i.e. native bees v. foreign strains such as the Italian bee) - and management.

- Varroa destructor a parasitic infestation, is now endemic and must be monitored - leave alone management is no longer an option. Bees have survived for 50 million years – Homo sapiens a mere 5 million years. Their organization is highly organized for the benefit of the whole colony not the individual.
- **Keeping bees in hives is for the benefit of the beekeeper not the bees. Always try to be in tune with their needs – not yours.**

Bee Egg Development.



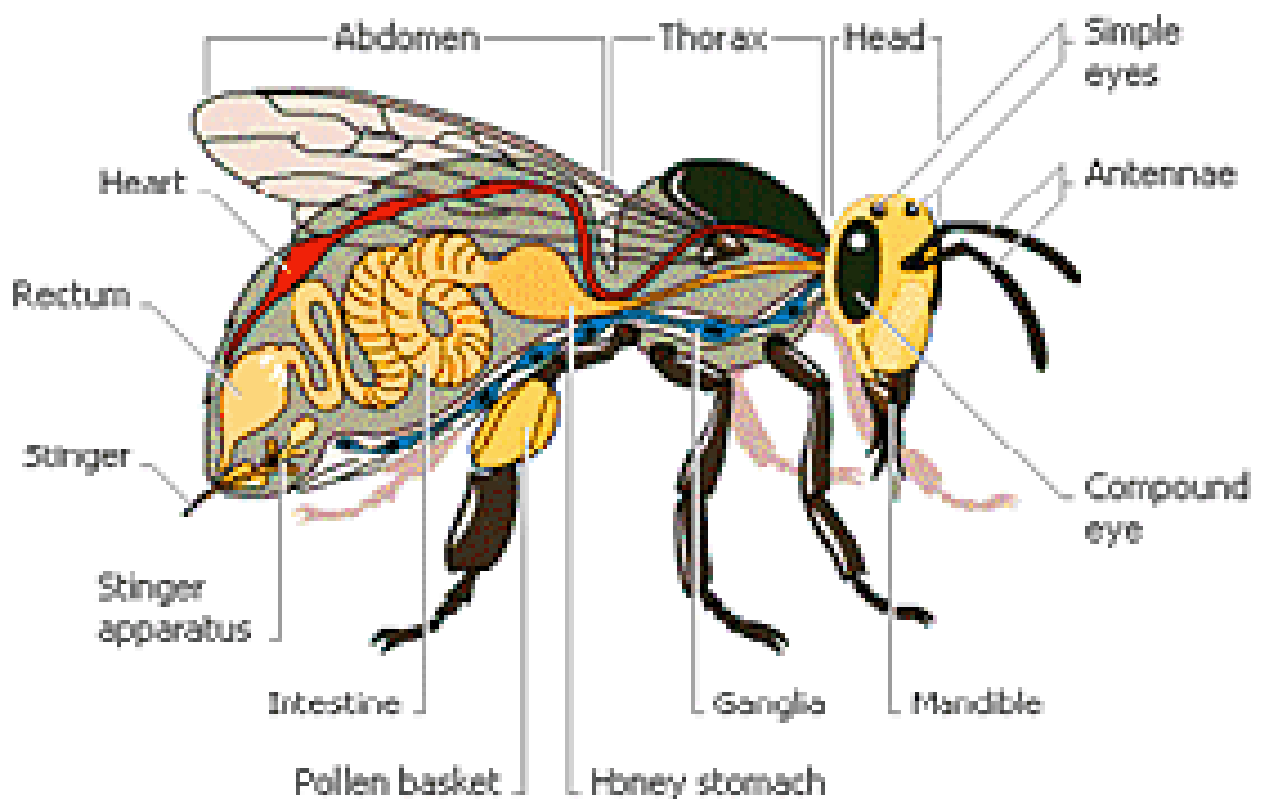
TIMES OF DEVELOPMENT (IN DAYS) OF QUEEN, WORKER AND DRONE



- Ants, bees and wasps are social insects. This means that they tend to live in colonies where all the individuals are of the same family, often the offspring of one mother. In the more highly organized societies there is a division of labour in which individuals carry out particular duties.

- Structure. The bodies of bees are divided into head, thorax and abdomen, with three pairs of legs and two pairs of wings on the thorax. The fore and hind wings on each side are linked by hooks and grooves so that they move together in flight.
- The mouth parts consist of a "tongue" or labium, which can be enclosed near the head by the labial palps and maxillae. Nectar, from the nectaries of flowers, can be drawn up the grooved surface of the labium, partly by capillary attraction and partly by the pumping action of muscles in the head. When not in use, these elongated mouth parts are folded back under the head, leaving the shorter, stouter mandibles free in front to chew pollen, manipulate wax, attack intruders etc.
- The ovipositor, through which the queen lays her eggs in the wax cell, is modified in the workers to form a sting.
- Organization of the colony. There are four species of *Apis*, the honey-bee, one of which is *Apis mellifera*, the Western honey-bee, which is the commonest hive-bee in this country. There are three kinds of bee in a colony: in the summer, a few hundred drones or males, one egg-laying female, or queen, and from 20 to 80 thousand sterile females or workers. The mature queen is usually easily recognized by her large abdomen.

The Honey Bee Inside out



Origins of 3 types of Bee

The Worker.



A **worker bee** is any female (eusocial) bee that lacks the full reproductive capacity of the colony's queen bee; under most circumstances, this is correlated to an increase in certain non-reproductive activities relative to a queen, as well. Worker bees occur in many bee species other than honey bees, but this is by far the most familiar colloquial use of the term.

Workers gather pollen into the pollen baskets on their back legs, to carry back to the hive where it is used as food for the developing brood. Pollen carried on their bodies may be carried to another flower where a small portion can rub off onto the pistil, resulting in cross pollination. Almost all of civilization's food supply (maize is a noteworthy exception) depends greatly on crop pollination by honey bees, whether directly eaten or used as forage crops for animals that produce milk and meat. Nectar is sucked up through the proboscis, mixed with enzymes in the stomach, and carried back to the hive, where it is stored in wax cells and evaporated into honey.

Honey bee workers keep the hive temperature uniform in the critical brood area (where new bees are raised). Workers must maintain the hive's brood chamber at 34.4 °C to incubate the eggs. If it is too hot, they collect water and deposit it around the hive, then fan air through with their wings causing cooling by evaporation. If it is too cold, they cluster together to generate body heat. This is an example of homeostasis.

The life of all honey bees starts as an egg, which is laid by the queen in the bottom of a wax cell in the brood area of a hive. A worker egg hatches after three days into a larva. Nurse bees feed it royal jelly at first, then pollen and honey for six days. It then becomes an inactive pupa.

Honeycombs have hexagonal cells on both sides of a vertical central wall, these cells are inclined upward, primarily to retain liquid nectar and honey. During its 14 days as a pupa, sealed in a capped cell, it grows into a worker (female) bee, emerging on the 20th day. In most species of honey bees, workers do everything but lay eggs and mate, though Cape honey bee workers can lay eggs. They build the comb from wax extruded from glands under their abdomen. They clean, defend, and repair the hive. They feed the larva, the queen, and the drones. They gather nectar, pollen, water, and propolis. They ventilate, cool and heat the hive.

When a colony absconds (all bees leave the colony) or divides and so creates a swarm and then establishes a new colony, the bees must regress in their behaviour in order to establish the first generation in the new home. The most urgent task will be the creation of new beeswax for comb. Beekeepers take advantage of this by introducing swarms into new or existing colonies where they will draw comb. Comb is much more difficult to come by than honey and requires

about six times the energy to create. A newly hived swarm on bars (top bar hive) or empty foundation (Langstroth box hive) will often be fed sugar water, which they can then rapidly consume to create wax for new comb (Mature hives cannot be so fed as they will store it in place of nectar, although a wintering hive may have to be fed if insufficient honey was left by the beekeeper).

Progression of tasks.

Cell cleaning (days 1–2)

Brood cells must be cleaned before the next use. Cells will be inspected by the queen and if unsatisfactory it will not be used. Worker bees in the cleaning phase will perform this cleaning. If the cells are not clean, the worker bee must do it again and again.

Nurse bee (days 3–11)

Nurse bees feed the worker larvae worker jelly which is secreted from glands in the hypopharynx of worker bees that produce royal jelly.

- **Advanced Nurse Bees (days 6–11)**
 - Feed royal jelly to the queen larva and drones receive worker jelly for 1 to 3 days at which time they are started on a diet of honey and pollen.

Wax production (days 12–17)

Wax bees build cells from wax, repair old cells, and store nectar and pollen brought in by other workers. Early in the worker's career she will exude wax from the space between several of her abdominal segments. Four sets of wax glands, situated inside the last four ventral segments of the abdomen, produce wax for comb construction.

Honey sealing

Mature honey, sufficiently dried, is sealed tightly with wax to prevent absorption of moisture from the air by workers deputized to do this.

Drone feeding

Drones do not feed themselves; they are fed by workers.

Queen attendants

The attendants groom and feed the queen. They also collect QMP (Queen Mandibular Pheromone) from the queen and share it with the bees around them who also share it spreading its effects through the hive.

Honeycomb building

Workers will take wax from wax producing workers and build the comb with it.

Pollen packing

Pollen brought into the hive for feeding the brood is also stored. It must be packed firmly into comb cells and mixed with a small amount of honey so that it will not spoil. Unlike honey, which does not support bacterial life, stored pollen will become rancid without proper care. It has to be kept in honey cells.

Propolizing

The walls of the hive are covered with a thin coating of propolis, a resinous substance obtained from plants. In combination with enzymes added by the worker this has antibacterial and antifungal properties.

Propolis is used to aide with ventilation and at the entrances of hives.

Mortuary bees

Dead bees and failed larvae must be removed from the hive to prevent disease and allow cells to be reused. They will be carried some distance from the hive by mortuary bees.

Fanning bees

Worker bees fan the hive, cooling it with evaporated water brought by water carriers. They direct airflow into the hive or out of the hive depending on need.

Water carriers

When the hive is in danger of overheating, these bees will obtain water, usually from within a short distance from the hive and bring it back to spread on the backs of fanning bees. The worker bee has a crop separate from the nectar crop for this purpose.

Foraging bees (days 22–42)

The forager and scout bees travel (up to 1.5 miles) to a nectar source, pollen source or to collect propolis.

Genetic Characteristics.

In most common bee species, worker bees are infertile due to enforced altruistic kin selection, and thus never reproduce. Workers are nevertheless considered female for anatomical and genetic reasons. Genetically, a worker bee does not differ from a queen bee and can even become a laying worker bee, but in most species will produce only male (drone) offspring. Whether a larva becomes a worker or a queen depends on the kind of food it is given after the first three days of its larval form.

The Stinger.



The worker bee's stinger is a complex organ that allows a bee to defend itself and the hive from most mammals. Attacking bees aim for the face by sensing regions with high levels of carbon dioxide (like mosquitos). Bee stings against mammals and birds typically leave the stinger

embedded in victim due to the structure of flesh and the stinger's barbs. In this case, the venom bulb stays with the stinger and continues to pump. Upon losing its stinger, the bee will subsequently die since the portion where the stinger bulb was removed rips out part of its insides.

The barbs on the stinger will not catch on most animals besides mammals and birds. This means that such animals can be stung many times by the same bee.

The Drone.



Genetics

Drones carry only one type of allele because they are haploid (containing only one set of chromosomes from the mother). During the queen's egg developing process, a diploid cell with 32 chromosomes divides to generate haploid cells called gametes with 16 chromosomes. The result is a haploid egg, with chromosomes having a new combination of alleles at the various loci. This process is also called arrhenotokous parthenogenesis or simply arrhenotoky.

There is much debate and controversy in the scientific literature about the dynamics and apparent benefit of the combined forms of reproduction in honey bees and other social insects, known as the haplodiploid sex-determination system. The drones have two reproductive functions. They convert and extend the queen's single unfertilized egg into about 10 million genetically identical male sperm cells. Secondly, they serve as a vehicle to mate with a new queen to fertilize her eggs. Female worker bees develop from fertilized eggs and are diploid in origin, which means that the sperm from a father provides a second set of 16 chromosomes for a total of 32, one set from each parent. Since all the sperm cells produced by a particular drone are genetically identical, sisters are more closely related than full sisters of other animals where the sperm is not genetically identical.

A laying worker bee will exclusively produce totally unfertilized eggs, which develop into drones. As an exception to this rule, laying worker bees in some sub-species of honey bees may also produce diploid (and therefore female) fertile offspring in a process called thelytoky. In thelytoky the second set of chromosomes comes not from sperm, but from one of the three polar bodies during anaphase II of meiosis.

In honey bees, the genetics of offspring can best be controlled by artificially inseminating a queen with drones collected from a single hive, where the drones' mother is known. In the natural mating process, a queen mates with multiple drones, which may not come from the same hive. Therefore, in the natural mating process, batches of female offspring will have fathers of a completely different genetic origin.

Description.

Drones are characterized by eyes that are twice the size of those of worker bees and queens, and a body size greater than that of worker bees, though usually smaller than the queen bee.

Their abdomen is stouter than the abdomen of workers or queen. Although heavy bodied, drones must be able to fly fast enough to accompany the queen in flight.

Their role

The drones' main function is to be ready to fertilize a receptive queen. Drones in a hive do not usually mate with a virgin queen of the same hive because they drift from hive to hive. Mating generally takes place in or near drone congregation areas. It is poorly understood how these areas are selected, but they do exist. When a drone mates with his sister, the resultant queen will have a spotty brood pattern (numerous empty cells on a brood frame). This is due to the removal of diploid drone larvae by nurse bees (i.e., a fertilized egg with two identical sex genes will develop into a drone instead of a worker).



In flight

Mating occurs in flight, which accounts for the need of the drones for better vision, which is provided by their large eyes. Should a drone succeed in mating he soon dies because the penis and associated abdominal tissues are ripped from the drone's body after sexual intercourse?

Honey bee queen breeders may breed drones to be used for artificial insemination or open mating. A queen mating yard must have many drones to be successful.

In areas with severe winters, all drones are driven out of the hive in the autumn. A colony begins to rear drones in spring and drone population reaches its peak coinciding with the swarm season in late spring and early summer. The life expectancy of a drone is about 90 days.

The Queen.



- A queen bee may live from two to five years and, except for a short period at the end of her life when one of her daughters takes over the colony, she is the only egg-laying female. All the members of the colony, whether drones or workers, are her offspring. She spends all her time laying eggs, perhaps up to 2000 a day, each one being placed in a wax cell made by the workers. She cannot feed herself and wherever she goes in the hive the nearest workers turn towards her, lick her body and feed her by regurgitating a special secretion of their salivary glands, called "royal jelly", on to their proboscis from which the queen can absorb it.
- The queen usually mates only once in her life (though second and third mating's are known to happen) and stores the sperms received from the drone in a sperm sac in her abdomen. This store of sperms lasts her for the two or more years of egg-laying, a small quantity being released with each fertilized egg laid.
- When the store of sperms is used up she may continue to lay eggs but they are all unfertilized and will become drones. By this time one of her daughters has been reared as a queen and is ready to take over the egg-laying.

Life of the Queen.

When a new queen emerges she is fed by the workers. She bites a hole in any other occupied queen cells that she finds and some observers believe she stings the occupants. In any event, the workers usually tear down the other queen cells that have been bitten into and destroy the occupants.

- For a few days the queen leaves the hive for short flights lasting, at first, only a minute but gradually lengthening to about 15 minutes. During these flights she learns the geography of the district around the hive. On one of these flights she is pursued by drones, but not necessarily from her own hive; in fact, they do not follow her from the hive but are already waiting outside. A few of them catches the queen and mates with her, depositing in her vagina sperms which eventually

find their way into her sperm sac. She now returns to the hive, and soon after begins to lay eggs.

- From glands in her head, the queen produces a mixture of chemicals called pheromones ('queen substance'). When the workers 'lick' her body, the pheromones suppress their fertility. When, at the end of her life, the queen ceases to produce these pheromones, some workers start to lay eggs which, being unfertilised, produce only drones. They do, however, start building new queen cells.

Division of Labour.

- The tasks undertaken by a worker bee depend partly on its age and partly on the immediate needs of the colony. Generally speaking, the worker's life follows the course described below, although the times given are very approximate and in many cases may not apply.
- After hatching, she is fed by other workers and spends a good deal of time standing still on the comb. She does, however, clean out cells from which bees have recently hatched by removing the cast larval cuticles. On the fourth day she feeds on honey from the store cells and eats a good deal of pollen. Between the third and fifth day she feeds older larvae by placing nectar, water and pollen in their cells.
- The pollen that she eats is rich in protein and helps her salivary, brood food glands to become active, so that by the fifth day they can secrete the brood food or royal jelly which is fed to the younger larvae. After ten or twelve days these glands cease to function effectively but wax glands on the underside of her abdomen begin to secrete wax which the worker uses for comb-building and repair. By this time she is also beginning to leave the hive for short flights during which she learns the position of the hive and the topography of the surroundings.
- Between the twelfth and twenty-first days these reconnaissance flights continue; while in the hive, the worker collects pollen and nectar from the incoming field bees and stores it in the cells. She also processes the nectar and begins its conversion to honey, and cleans the hive by removing the dead bees and detritus from its floor.
- After three weeks of hive duties the worker becomes a forager and spends the daylight hours collecting water, nectar, pollen and propolis and carrying it back to the hive. This work she may continue for about three weeks before she dies.
- The "schedule" given above is by no means rigid, and observers have recorded bees doing several of the duties mentioned at the same time, as well as old bees performing "nurse" duties, and young bees foraging. Some of the duties may be missed out altogether. For example, only a few of the young foragers do duty as guard bees, protecting the hive from invasion by robber bees and any mammal that may try to enter the hive .
- Food. The foraging workers collect nectar from the nectaries of flowers. The nectar is drawn off from the nectaries by the long labium. It is pumped up and swallowed into

the honey sac, a region of the gut from which it can be regurgitated on reaching the hive. Nectar is a watery sugar solution when collected, but it is processed by the house bees to whom it is passed. These workers repeatedly swallow it, mix it with enzymes and regurgitate it. The enzyme action and the evaporation of water result finally in its conversion to honey. Nectar contains very little protein, and the pollen collected by the foragers makes up this deficiency.

- Pollen is collected by combing off with the legs the grains which adhere to the bee's body after it has visited a flower. The pollen collected on the head, and removed by the front legs, is mixed with a little nectar and passed to the back legs which have combed pollen from the abdomen. The rows of bristles on the legs assist this combing action. The pollen press, in the joint between the tibia and tarsus of the hind legs, squeezes the pollen which is passed to it from the pollen comb of the opposite hind leg. The pollen and nectar paste is thus pushed by the press into the pollen basket on the tibia, where it is retained by the fringe of setae. All this may be done while the bee hovers in the air or while hanging from the flower. The forager returns to the hive with the two packs of pollen and pushes them off into an empty cell or into one with some pollen already in it.
- The younger house bees then break up the pollen masses and pack them down into the cell. When the cell is full it may be covered with a little nectar and sealed over. Both pollen and honey sealed in the store cells are eaten by the bees in the winter months when no other food is available. Water is collected and used to dilute the nectar with which the larvae are fed, but there is no evidence of water being stored.
- Propolis is a resinous substance that the bees collect from trees and sticky buds. They use it for sealing small cracks and gaps in the hive and is the bee's natural antibiotic defence against disease.

Swarming.



A new honey bee colony is formed when the queen bee leaves the colony with a large group of flying, worker bees, a process called **swarming**. In the *prime swarm*, about 60% of the flying worker bees leave the original hive location with the old queen. This swarm can contain thousands to tens of thousands of bees. Swarming is mainly a spring phenomenon, usually within a two- or three-week period depending on the locale, but occasional swarms can happen throughout the producing season. **Swarming** is the natural means of reproduction of honey bee colonies.

Secondary *after swarms* may happen but are rare. After swarms are usually smaller and are accompanied by one or more virgin queens. Sometimes a beehive will swarm in succession until it is **almost totally depleted of workers**.

Entomologists consider the colony as a super organism. An individual bee without a colony cannot survive for long. The colony also needs a certain colony size to reproduce. In the process of swarming the original single colony reproduces to two and sometimes more colonies.

A swarm of bees sometimes frightens people, though the bees are usually not aggressive at this stage of their life cycle. This is principally due to the swarming bees' lack of brood (developing bees) to defend and their interest in finding a new nesting location for their queen. This does not mean that bees from a swarm will not attack if they perceive a threat; however, most bees only attack in response to intrusions against their colony. Additionally, bees seldom swarm except when the position of the sun is direct and impressive. Swarm clusters, hanging off of a tree branch, will move on and find a suitable nesting location in a day or two. Beekeepers are sometimes called to capture swarms that are cast by feral honey bees or from the hives of domestic beekeepers.

The worker bees create *queen cups* throughout the year. When the hive gets ready to swarm the queen lays eggs into the queen cups. New queens are raised and the hive may swarm as soon as the queen cells are capped and before the new virgin queens emerge from their queen cells. A laying queen is too heavy to fly long distances. Therefore, the workers will stop feeding her before the anticipated swarm date and the queen will stop laying eggs. Swarming creates an interruption in the brood cycle of the original colony. During the swarm preparation, scout bees will simply find a nearby location for the swarm to cluster. This intermediate stop is not for permanent habitation and will normally leave within three days to a suitable location. It is from this temporary location that the cluster will determine the final nest site based on the level of excitement of the dances of the scout bees.

When a honey bee swarm emerges from a hive they do not fly far at first. They may gather in a tree or on a branch only a few meters from the hive. There, they cluster about the queen and send 20 - 50 scout bees out to find a suitable new nest locations. The scout bees are the most experienced foragers in the cluster. An individual scout returning to the cluster promotes a location she has found. She uses a dance similar to the waggle dance to indicate direction and distance to others in the cluster.

The more excited she is about her findings the more excitedly she dances. If she can convince other scouts to check out the location she found, they may take off, check out the proposed site and promote the site further upon their return. Several different sites may be promoted by different scouts at first.

After several hours and sometimes days, slowly a favourite location emerges from this decision making process. In order for a decision to be made in a relatively short amount of time (the swarm can only survive for about three days on the honey on which they gorged themselves before leaving the hive), a decision will often be made when somewhere around

80% of the scouts have agreed upon a single location. When that happens, the whole cluster takes off and flies to it.

A swarm may fly a kilometre or more to the scouted location. This collective decision making process is remarkably successful in identifying the most suitable new nest site and keeping the swarm intact. A good nest site has to be large enough to accommodate the swarm (about 15 litres in volume), has to be well protected from the elements, receive a certain amount of warmth from the sun and be not infested with ants.

Swarming creates a vulnerable time in the life of honey bees. Cast swarms are provisioned only with the nectar or honey they carry in their stomachs. A swarm will starve if it does not quickly find a home and more nectar stores. This happens most often with early swarms that are cast on a warm day that is followed by cold or rainy weather in spring.

The remnant colony after having cast one or more swarms is usually well provisioned with food, but the new queen can be lost or eaten by predators during her mating flight, or poor weather can prevent her mating flight. In this case the hive has no further young brood to raise additional queens, and it will not survive.

As soon as an after swarm (the second and subsequent swarm after the old queen leaves with the prime swarm) is established at a new location, the bees raise a new queen, or sometimes a replacement virgin queen is already present in the after swarm.

Senses and Communication.



- The senses of touch and smell, particularly through the antennae, are very important to bees in finding sources of food, in identifying members of their own colony, and sometimes in finding their way home. Their compound eyes are sensitive to certain groups of colours though colour-blind to red. In the darkness of the hive they must depend on touch and smell to carry out their activities. They

find their way to and from the hive by learning the landmarks in the vicinity and steering by the position of the sun.

- A bee which has found a rich source of food will return to the hive and execute a dance on the surface of the comb. It takes the form of a figure eight with a straight section in the middle. The length of the straight section is proportional to the distance of the flowers from the hive, and the angle it makes with the vertical represents the angle between the position of the sun, the hive and the source of food. In addition.
- The dancer may make wagging movements of her body on the straight section, which indicates distance. Some of the foraging bees in the hive follow the dance, touching the dancer with their antennae. From time to time the dancer stops and, regurgitating a little of the nectar she has collected from the flowers, she feeds the attentive workers. The dance pattern, the taste of the nectar and sometimes the scent of the flowers on the dancer's body enable the workers to find the feeding ground from which the dancer, has just returned.

Our part in Beekeeping.



- Although humans cannot tame the honey bee they can exploit its activities. A hive is provided which can be opened and examined without unduly disturbing the colony. It is fitted with vertical wooden frames in which the bees can build their combs. The frames have, wired into their centre, a sheet of wax which is indented with a hexagonal pattern so that the workers build their combs within the confines of the frame, and each comb can then be removed separately. By means of a grid, called a queen excluder through which the workers but not the queen can pass, the queen is kept in the lower section of the hive. As a result, the combs in the upper

sections will contain no grubs but only pollen and nectar. It is from these "supers" that the honey is eventually removed by the bee-keeper. In the autumn and spring the bees are given sugar solution to compensate them for the honey taken from their winter store.

- In addition to their value as honey producers, the part played by bees in pollination is very important. In apple orchards and clover fields, for example, the yields have been greatly increased by keeping a hive of bees in the locality. Efficient pollination leads to complete fertilization of all the ovules in an ovary, which subsequently leads to better fruit pollination.

And in conclusion.

The biology of the honey bee is a very complex subject and I have only covered a small part of what goes on with these fascinating insects, as to do it all would take volume upon volume of books, and as it's only a book for beginners would also overwhelmed most people who are reading.

I therefore suggest, that if you are interest more, to contact your local club or association who will advise you more.

We will now move onto the next subject, which is pests and diseases of the honey bee, which you really need to know about, as if not you will surely get into serious trouble and could end up losing them if the problem is not corrected.

7. Pests and Diseases you will need to be aware of.

Pests.

Varroa.



Varroa destructor are parasitic mites that feed off the bodily fluids of adult, pupal and larval bees.

Varroa mites can be seen with the naked eye as a small red or brown spot on the bee's thorax. Varroa are carriers for a virus that is particularly damaging to the bees. Bees that are infected with this virus during their development will often have visibly deformed wings.

Varroa have led to the virtual elimination of feral bee colonies in many areas and is a major problem for kept bees in apiaries. Some feral populations are now recovering but at the moment we are not sure why.

Varroa were first discovered in Southeast Asia in about 1904, but is now present on all continents except Australia. Varroa were discovered in the United States in 1987, in New Zealand in 2000, and in the United Kingdom in 1992 (Devon).

Varroa are generally not a problem for a hive that is growing strongly. When the hive population growth reduced in preparation for winter or due to poor late summer forage the mite population growth can overtake that of the bees and can then destroy the hive. Often a colony will simply abscond (leave as in a swarm, but leaving no population behind) under such conditions.

Varroa in combination with Deformed Wing Virus and bacteria have been theoretically implicated in Colony Collapse Disorder.

Varroa destructor can only reproduce in a honey bee colony. It attaches to the body of the bee and weakens the bee by sucking hemolymph. In this process, RNA viruses such as the deformed wing virus (DWV) spread to bees. A significant mite infestation will lead to the death of a honey bee colony, usually in the late autumn through early spring. The **Varroa** mite is the parasite with the most pronounced economic impact on the beekeeping industry. It may be a contributing factor to colony collapse disorder, as research shows it is the main factor for collapsed colonies in Ontario, Canada and Hawaii, USA.

Mites reproduce on a 10-day cycle. The female mite enters a honey bee brood cell. As soon as the cell is capped, the **Varroa** mite lays eggs on the larva. The young mites, typically several females and one male, hatch in about the same time as the young bee develops and leave the cell with the host. When the young bee emerges from the cell after pupation, the **Varroa** mites also leave and spread to other bees and larvae. The mite preferentially infests drone cells.

The adults suck the "blood" (hemolymph) of adult honey bees for sustenance, leaving open wounds. The compromised adult bees are more prone to infections. With the exception of some resistance in the Russian strains and bees with Varroa-sensitive hygiene genes developed, the European *Apis mellifera* bees are almost completely defenceless against these parasites (Russian honey bees are one-third to one-half less susceptible to mite reproduction).

The model for the population dynamics is exponential growth when bee brood are available and exponential decline when no brood is available. In 12 weeks, the number of mites in a western honey bee hive can multiply by (roughly) 12. High mite populations in the autumn can cause a crisis when drone rearing ceases and the mites switch to worker larvae, causing a quick population crash and often hive death.



Low temperature scanning electron micrograph of *V. destructor* on a honey bee host

Varroa mites have been found on flower-feeding insects such as the bumblebee *Bombus pennsylvanicus*, the scarab beetle *Phanaeus vindex* and the flower-fly *Palpada vinetorum*. Although the **Varroa** mite cannot reproduce on these insects, its presence on them may be a means by which it spreads short distances (phoresy).

Introduction around the world.

- Early 1960s Japan, USSR
- 1960s-1970s Eastern Europe
- 1971 Brazil
- Late 1970s South America
- 1980 Poland
- 1982 France
- 1984 Switzerland, Spain, Italy
- 1987 Portugal
- 1987 USA
- 1989 Canada
- 1992 England
- 2000 New Zealand (North Island)
- 2006 New Zealand (South Island)
- 2007 Hawaii (Oahu, Hawaii Island)

As of mid-2012, Australia was thought to be free of the mite. In early 2010, an isolated subspecies of bee was discovered in Kufra (south-eastern Libya) that appears to be free of the mite.

Description.

Until recently, *V. destructor* was thought to be a closely related mite species called **Varroa jacobsoni**. Both species parasitize the Asian honey bee, *Apis cerana*. However, the species originally described as *V. jacobsoni* by Anthonie Cornelis Oudemans in 1904 is not the same species that also attacks *Apis mellifera*. The jump to *A. mellifera* probably first took place in the Philippines in the early 1960s where imported *A. mellifera* came into close contact with infected *A. cerana*. Until 2000, scientists had not identified *V. destructor* as a separate species. This late identification in 2000 by Anderson and Trueman corrected some previous confusion and mislabelling in the scientific literature

Varroatosis.

The infection and subsequent parasitic disease caused by **Varroa mites is called Varroatosis**. Treatments have been met with limited success. First, the bees were medicated with fluvalinate, which had about 95% mite falls. However, the last five percent became resistant to it, and later, almost immune. Fluvalinate was followed by coumaphos.

Preventive measures and treatments.

Chemical measures

Varroa mites can be treated with commercially available miticides. Miticides must be applied carefully to minimize the contamination of honey that might be consumed by humans. Proper use of miticides also slows the development of resistance of the mites.

Synthetic chemicals

- Pyrethroid insecticide (Apistan) as strips
- Organophosphate insecticide (Coumaphos (Check-mite)) as strips
- Manley's Thymol Crystal and surgical spirit recipe with sugar as food^[13]

Naturally occurring chemicals

- Formic acid as vapour or pads (Mite-Away)
- Powdered sugar (Dowda method), talc, or other "safe" powders with a grain size between 5 and 15 μm (0.20 and 0.59 mil) can be sprinkled on the bees.
- Essential oils, especially lemon, mint and thyme oil^[14]
- Sugar esters (Sucrocide) in spray application
- Oxalic acid trickling method or applied as vapour
- Mineral oil (food grade) as vapour and in direct application on paper or cords
- Natural hops compounds in strip application (Hopguard)

Physical, mechanical, behavioural methods.

Varroa mites can also be controlled through nonchemical means. Most of these controls are intended to reduce the mite population to a manageable level, not to eliminate the mites completely.

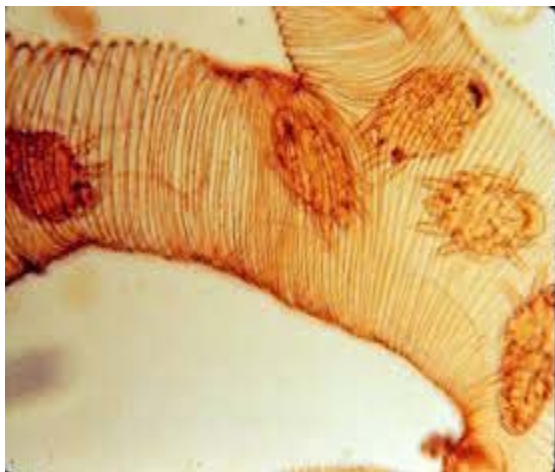
- **Heating method**, first used by beekeepers in Eastern Europe in the 1970s and later became a global method. In this method, hive frames are heated to a certain temperature for a period of time, which kills the *Varroa* larvae, but doesn't harm the bees and broods. In Germany, anti-*Varroa* heaters are manufactured for use by professional bee keepers.
- **Perforated bottom board method** is used by many beekeepers on their hives. When mites occasionally fall off a bee, they must climb back up to parasitize another bee. If the beehive has a screened floor with mesh the right size, the mite will fall through and cannot return to the beehive. The screened bottom board is also being credited with increased circulation of air, which reduces condensation in a hive during the winter. Screened bottom boards with sticky boards separate mites that fall through the screen and the sticky board prevents them from crawling back up.
- **Limited drone brood cell method**, is based on limiting the brood space cell for *Varroa* mites to inhabit (4.9 mm across — about 0.5 mm smaller than standard), and also to enhance the difference in size between worker and drone brood, with the intention of making the drone comb traps more effective in trapping *Varroa* mites. Small cell foundations have staunch advocates, though controlled studies have been generally inconclusive.
- **Comb trapping method** (also known as swarming method), is based on interrupting the honey bee brood cycle. It is an advanced method that removes capped brood from the hive, where the *Varroa* mites breed. The queen is confined to a comb using a comb cage. At 9-day intervals, the queen is confined to a new comb, and the brood in the old comb is left to be reared. The brood in the previous comb, now capped and infested with *Varroa* mites, is removed. The cycle is repeated. This complex method can remove up to 80% of *Varroa* mites in the hive.

- **Freezing drone brood method** takes advantage of *Varroa* mites' preference for longer living drone brood. The beekeeper will put a frame in the hive that is sized to encourage the queen to lay primarily drone brood. Once the brood is capped, the beekeeper removes the frame and puts it in the freezer. This kills the *Varroa* mites feeding on those bees. It also kills the drone brood, but most hives produce an excess of drone bees, so it is not generally considered a loss. After freezing, the frame can be returned to the hive. The nurse bees will clean out the dead brood (and dead mites) and the cycle continues.
- **Drone brood excision method** is a variation applicable to top bar hives. Honey bees tend to place comb suitable for drone brood along the bottom and outer margins of the comb. Cutting this off at a late stage of development ("purple eye stage") and discarding it reduces the mite load on the colony. It also allows for inspection and counting of mites on the brood.

Genetic engineering

Researchers have been able to use RNA interference to knock out genes in the *Varroa* mite. The aim is to change the bee's genetic traits so that the bees can smell infected brood and remove them before the infestation spreads further.

Acarine (Tracheal) Mites.



Acarapis woodi is a small parasitic mite that infests the airways of the honey bee. The first known infestation of the mites occurred in the British Isles in the early 20th century. First observed on the Isle of Wight in 1904, the mystery illness known as *Isle of Wight Disease* was not identified as being caused by a parasite until 1921. It quickly spread to the rest of Great Britain. It was regarded as having wiped out the entire native bee population of the British Isles (although later genetic studies have found remnants that did survive) and it dealt a devastating blow to British beekeeping. Brother Adam at the Buckfast Abbey developed a resistant hybrid bee known as the Buckfast bee, which is now available worldwide to combat Acarine disease.

Diagnosis for tracheal mites generally involves the dissection and microscopic examination of a sample of bees from the hive.

Acarine mites, formerly known as **tracheal mites** are believed to have entered the US in 1984, via Mexico.

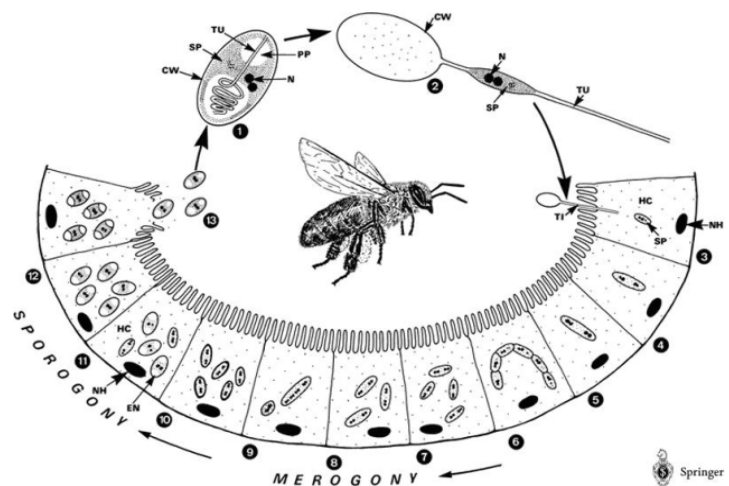
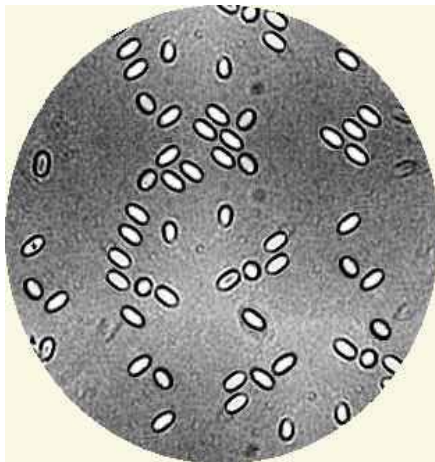
Mature female Acarine mites leave the bee's airway and climb out on a hair of the bee, where they wait until they can transfer to a young bee. Once on the new bee, they will move into the airways and begin laying eggs.

Treatment.

Acarine mites are commonly controlled with grease patties (typically made from 1 part vegetable shortening mixed with 3–4 parts powdered sugar) placed on the top bars of the hive. The bees come to eat the sugar and pick up traces of shortening, which disrupts the mite's ability to identify a young bee. Some of the mites waiting to transfer to a new host will remain on the original host. Others will transfer to a random bee—a proportion of which will die of other causes before the mite can reproduce.

Menthol, either allowed to vaporize from crystal form or mixed into the grease patties, is also often used to treat Acarine mites.

Nosema.



Nosema apis is a microsporidian that invades the intestinal tracts of adult bees and causes nosema disease, also known as nosemosis. Nosema is also associated with Black queen-cell virus. Nosema is normally only a problem when the bees cannot leave the hive to eliminate waste (for example, during an extended cold spell in winter or when the hives are enclosed in a wintering barn). When the bees are unable to void (cleansing flights), they can develop dysentery.

Nosema is treated by increasing the ventilation through the hive. Some beekeepers will treat a hive with antibiotics such as fumagillan. **Please not that fumagillan is now banned for use within the EEC.**

Nosema can also be prevented or minimized by removing much of the honey from the beehive then feeding the bees on sugar water in the late autumn. Sugar water made from refined sugar has lower ash content than flower nectar, reducing the risk of dysentery. Refined sugar, however, contains fewer nutrients than natural honey which causes some controversy among beekeepers

In 1996, a similar type of organism to ***Nosema apis*** was discovered on the Asian honey bee *Apis cerana* and subsequently named ***Nosema ceranae***. This parasite apparently also infects the Western honey bee.

Small Hive Beetle.



Aethina tumida is a small, dark-coloured beetle that lives in beehives. Originally from Africa, the first discovery of small hive beetles in the western hemisphere occurred in the US. **They are not yet present in the UK**

The life cycle of this beetle includes pupation in the ground outside of the hive. Controls to prevent ants from climbing into the hive are believed to also be effective against the hive beetle. Several beekeepers are experimenting with the use of diatomaceous earth around the hive as a way to disrupt the beetle's lifecycle. The diatoms abrade the insect's surface, causing them to dehydrate and die.

Several pesticides are currently used against the small hive beetle. The chemical is commonly applied inside the corrugations of a piece of cardboard. Standard corrugations are large enough that a small hive beetle will enter the cardboard through the end but small enough that honey bees cannot enter (and thus are kept away from the pesticide). Alternative controls (such as cooking-oil-based bottom board traps) are also becoming available. Also available are beetle eater that go between the frames that uses cooking oil.

Wax Moth.

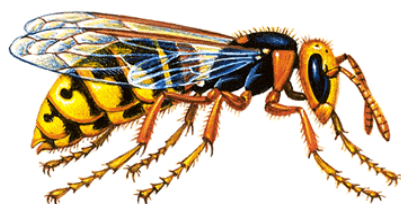


- ***Galleria mellonella*** (greater wax moths) will not attack the bees directly, but feed on the wax used by the bees to build their honeycomb. Their full development to adults requires access to used brood comb or brood cell cleanings—these contain protein essential for the larvae's development, in the form of brood cocoons.
- The destruction of the comb will spill or contaminate stored honey and may kill bee larvae.
- When honey supers are stored for the winter in a mild climate, or in heated storage, the wax moth larvae can destroy portions of the comb, even though they will not fully develop. Damaged comb may be scraped out and will be replaced by the bees. Wax moth larvae and eggs are killed by freezing, so storage in unheated sheds or barns in higher latitudes is the only control necessary.
- The can be a problem to us beekeepers in the UK if not properly controlled.

Control and Treatment of Wax Moth.

- A strong hive generally needs no treatment to control wax moths; the bees themselves will kill and clean out the moth larvae and webs. Wax moth larvae may fully develop in cell cleanings when such cleanings accumulate thickly where they are not accessible to the bees.
- Wax moth development in comb is generally not a problem with top bar hives as unused combs are usually left in the hive during the winter. Since this type of hive is not used in severe wintering conditions, the bees will be able to patrol and inspect the unused comb.
- Wax moths can be controlled chemically **Acetic Acid** being placed at the bottom of stored brood , supers and combs
- If chemical methods are used, the combs must be well-aired-out for several days before use.
- The use of naphthalene (mothballs) is discouraged because it accumulates in the wax, which can kill bees or contaminate honey stores.
- Control of wax moths by other means includes the freezing of the comb for at least twenty-four hours.

Wasps and Hornets.



Early in the year wasps collect meat and carrion, including dead bees, which they masticate and pass on to feed their larvae in the nest. The protein helps the new bodies grow and the larvae in turn excrete a sugary honeydew which satisfies the wasp's sweet tooth. In late summer/early autumn, the larvae have hatched and the adult wasps have to seek their sugar fix elsewhere, gate crashing picnics and making forays into beehives.

Prevention.

Site of hive

Rubbish. Although it is unlikely, do check your bee hive isn't situated near rubbish bins or other sources of abandoned sugary substances.

Fruit Are there any fruit trees nearby, as fruit rotting on the ground will attract wasps into the vicinity.

Aphids The honeydew from insects (usually aphids) on trees can also appeal to wasps.

Weak colony/nuc

If you can rule out the above, the most likely answer to why the wasps are attacking your bee

hive is, unfortunately, that the colony is weak enough to make it worth their while. They try it on with most hives at some point but will persist in numbers if they have success.

Are you feeding sugar to your bees?

What may be attracting wasps is sugar syrup fed at this time of year. Your bees may be strong enough to fight them off but they will spend a lot of energy doing so.

What can you do?

Narrow the entrance.

Try to spot the problem early. Watch the entrance especially towards the end of summer and narrow the entrance of the hive to make it easier for the bees to defend. They can manage with a very small opening but do allow enough room for them to remove any dead bees from the hive.

Feeding the bees.

Make sure your feeders are enclosed so that wasps cannot get to the sugar and avoid spillage.

Future prevention.

Some strains of honey bee are more docile than others. The benefit of you not being stung may not outweigh the benefits to the bees of being able to defend themselves.

Traps.

Jam jars containing a sweet solution will definitely drown wasps. Whether or not this has any serious effect on the numbers is difficult to determine.

Ants.



Ants can sometimes be a problem which is easily solves by putting the legs of the stands into oil which will prevent them getting into the hive.

Rats and Mice.



Rats and mice can be a problem if your bees are dormant. They will get into the hive and wreck everything and with the bees being too cold to defend themselves you will end up with a destroyed hive. Any other time they are no problem they are no problem, as the bees will sting them stop them entering the hive.

Easy to solve by closing down the entrance or putting on a mouse guard.



Woodpeckers.



To protect our bee hives against Woodpeckers who occasionally attack colonies usually in late winter when insects are hard to find and other food sources are scarce. They can rip into either a wooden or polystyrene a hive in seconds creating a two inch wide hole through which the woodpecker can make quite a meal from the thousands of bees inside trying to defend the hive. A hole that size is impossible for the remaining bees to close up and usually the whole colony is dead from cold or rain entering the hive within days.

It seems that only Green Woodpeckers attack hives in certain areas at certain times, and it's thought that it may be where families or groups of birds teach each other how to attack bee hives. It's also interesting how the woodpeckers seem to know exactly where the weakest point is and always attack where the hive material is at its thinnest, usually where the handholds are on the side of the hives.



Hive protected with plastic mesh for winter.

So to counter this, we have to protect our hives with either chicken wire or in my case plastic mesh fencing. The mesh is big enough to let the bees through, but too small for the woodpeckers, preventing them from getting too close to the hive exterior. We usually fit these at the end of December or early January once we have treated the colonies with oxalic acid to greatly reduce the numbers of Varroa mites attacking the bees. The bamboo poles hold the mesh away from the hive body and can easily be removed, allowing the mesh to be lifted away if we need to inspect the inside of the hive or feed the colony for any reason.

The mesh will stay in place now for the next few months keeping the Bee Good colonies safe and sound until later in the spring when the weather has warmed up and the woodpeckers have plenty of other insect food available.

Badgers. And other wild animals.



In winter they can be a pest so put some stones on the hive so they cannot knock them over. In summer you should have no problems as once stung they will keep away.

Livestock.



Again like wild animals they can, in winter they can be a pest so put some stones on the hive so they cannot knock them over. In summer you should have no problems as once stung they will keep away.

Diseases.

American Foulbrood.

- American Foul Brood (AFB), caused by the spore- forming *Paenibacillus* larvae (formerly classified as *Bacillus* larvae), is the most widespread and destructive of the bee brood diseases.
- *Paenibacillus* larvae is a rod-shaped bacterium, which is visible only under a high power microscope. Larvae up to 3 days old become infected by ingesting spores that are present in their food.
- Young larvae less than 24 hours old are most susceptible to infection. Spores germinate in the gut of the larva and the vegetative form of the bacteria begins to grow, taking its nourishment from the larva. Spores will not germinate in larvae over 3 days old. Infected larvae normally die after their cell is sealed. The vegetative form of the bacterium will die but not before it produces many millions of spores. Each dead larva may contain as many as 100 million spores. This disease only affects the bee larvae but is highly infectious and deadly to bee brood. Infected larvae darken and die. **American Foul Brood is a notifiable disease and comes under the Bee Diseases and Pest Control Orders**
- **It is subject to official control by a program of apiary inspections which are carried out by the National bee Unit (NBU).**



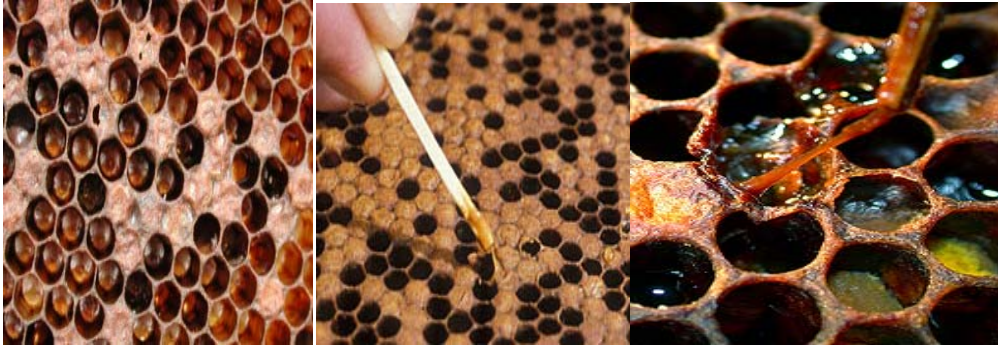
- **Control in the UK is by compulsory destruction of infected colonies, which is a very effective.**
- This method of control was introduced in the 1940s and brought the incidence of foul brood from several thousand incidents per year to less than 100 today.
- Some overseas countries use antibiotics to control American Foulbrood, which are not effective and serve only to suppress signs of the disease without eradicating it.
- **The use of any antibiotics to try to control American Foul Brood is not permitted in the UK**

History.

Until 1906 the two foulbrood diseases were not differentiated and the condition was generally referred to as foulbrood. Thereafter, the terms European and American were used to distinguish the diseases. However the designations did not refer to the geographical distributions but to the areas where they were first investigated scientifically. In 1907 it was demonstrated conclusively that a bacterium called *Bacillus* larvae was the cause of American foulbrood. The geographical origin of AFB is unknown, but it is found almost worldwide.

Diagnosis.

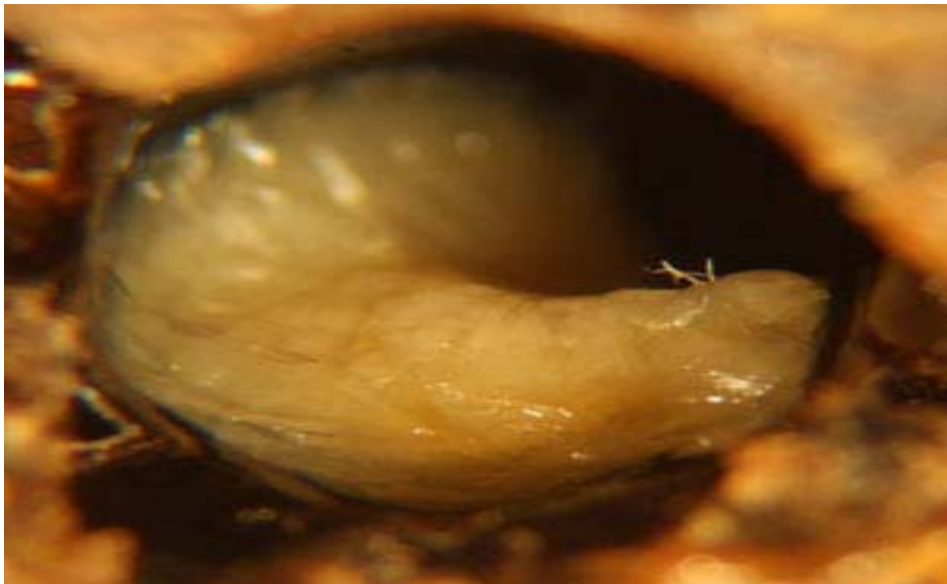
Lab testing is necessary for definitive diagnosis, but a good field test is to touch a dead larva with a toothpick or twig. It will be sticky and "ropey" (drawn out). Foulbrood also has a characteristic odour, and experienced beekeepers with a good sense of smell can often detect the disease upon opening a hive. Capped cells with decomposing larvae are sunken. Some caps may be torn, as well. Compare with healthy brood. The most reliable disease diagnosis is done by sending in some possibly affected brood comb to a laboratory specialized in identifying honey bee diseases.



Treatment.

- Because of the persistence of the spores (which can survive up to 40 years), UK Apiary Inspectors require an AFB diseased hive to be burned completely. Also it is a notifiable disease and failure to notify National bee Unit (NBU) can and will lead to prosecution.

European Foulbrood.



A classic symptom of European foulbrood is a curled upwards, flaccid, and brown or yellowish dead larva in its cell,

- European Foulbrood is a notifiable disease and is subject to official control by examination of the colonies by the Bee Inspector

Treatment is compulsory.

- Weak colonies and colonies with a high proportion of diseased brood are destroyed as with American Foulbrood.
 - Lightly diseased colonies can be treated by antibiotics but must be treated by the Bee Inspector using drugs that have been officially dispensed following confirmation that the colony has European Foulbrood.
- Control by the shook swarm method has been shown to be effective and is another option that can be used.

Cause

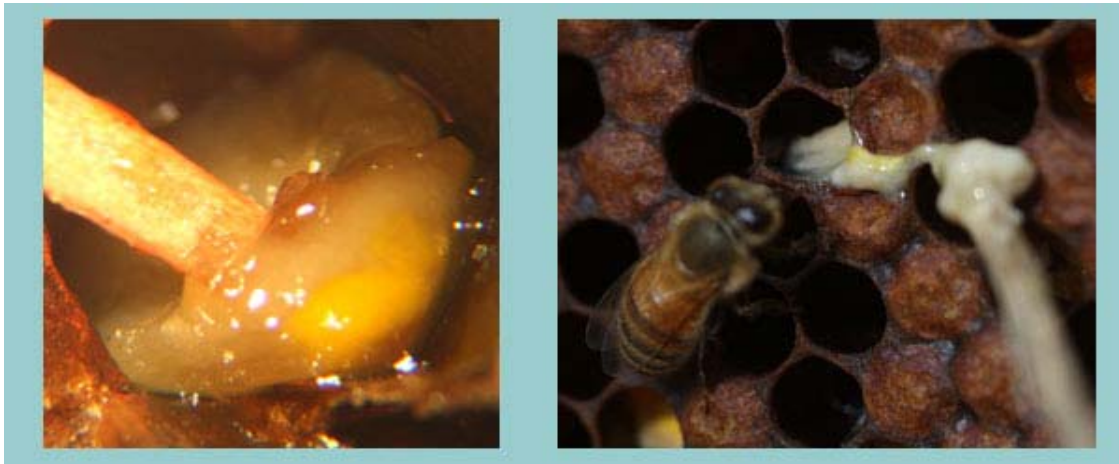
The causative agent of European Foul Brood (EFB) is the bacterium *Melissococcus plutonius*. The bacteria multiply in the mid-gut of infected larvae, competing with the larva for its food. Larvae that die from the disease do so due to starvation. This normally occurs shortly before their cells are due to be sealed.

Progression of the disease

The development of the disease within the colony is complex, and still not understood. It appears that infection can develop over a period of months or years, debilitating but not killing the colony. During this time, signs of the disease can become more or less severe, or disappear altogether. This may be due to how well the larvae are fed. When infected larvae are less well fed they are likely to suffer from starvation and die, but at times of plenty when infected larvae receive an abundance of brood food they will survive. However, when these larvae pupate they void their gut contents into the cell, contaminating the comb with infective bacteria. It is likely that the disease will eventually reach a level where most of the brood is infected, weakening and killing the colony.

Signs of European Foul Brood.

- EFB affects mainly unsealed brood, killing larvae before they are sealed in their cells.
- The EFB infected larva moves inside its cell instead of remaining in the normal coiled position characteristic of a healthy larva of the same age.
- When it dies it lies in an unnatural attitude – twisted spirally around the walls, across the mouth of the cells or stretched out lengthways from the mouth to the base.
- The dead larva often collapses as though it had been melted, turning yellowish-brown and eventually drying up to form a loosely attached brown scale unlike the hard black attached scales of AFB.
- When a high proportion of the larvae are being killed by EFB, the brood pattern will often appear patchy and erratic.
- A very unpleasant odour may sometimes accompany severe EFB infection, depending on the presence of certain other species of bacteria in the remains of dead larvae.
- A minority of infected larvae may die after the cell is sealed. In such cases, there may be sunken perforated capping's resembling AFB infection. However, the cell contents although brown and sticky cannot be drawn into a 'rope' as with AFB.



Probing a larva melted by European foulbrood. Note that the melted larva is usually not ropey.

Diagnosis and Control of EFB

European Foul Brood is a Notifiable Disease under the Bee Diseases and Pests Control Order 2006. A Bee Inspector should be called upon to confirm any suspicions and a sample can be immediately diagnosed within the apiary using a field test kit. Samples of suspect comb may be submitted to the National Bee Unit at York. Here, fully trained staff carry out a rapid and effective diagnosis. Beekeepers can buy an EFB test kit with full instructions for around £10 per test, **but EFB is notifiable and so the Bee Inspector must be called immediately if disease is suspected. The bee inspector will inspect and test your suspected colonies free of charge.**

When a sample is diagnosed positive for EFB, weak or heavily infected colonies must be destroyed. Lightly infected colonies may be restored to health by shook swarm method, shaking them into a clean brood box installed with frames of new foundation. The bees will then start afresh with pristine combs. This method is called the “shook swarm” treatment. Treatment with antibiotic oxytetracycline administered by the Bee Inspector is permitted in limited circumstances, but a six month withdrawal period is laid down for any honey coming from that colony. The law does not permit the presence of detectable residues of antibiotics in food.

If you suspect you have found EFB, you MUST report it to the NBU via your Bee Inspector.

Rules for Foul Brood Control

1. Inspect your colonies every spring and autumn, specifically to check for brood disease. If you are unsure, seek advice from an experienced beekeeper in your locality. This is a good time to transfer brood frames from their over-wintered brood box into a newly scorched brood box. Scorch with a blow lamp.
2. Do not transfer combs between colonies or divide colonies if you have any doubts about their health.
3. Never bring colonies, comb or beekeeping equipment into the apiary unless you are sure that they come from a disease-free source. Always scorch second-hand hives with a blow-lamp before use.
4. If a colony of bees dies out, seal the hive to prevent robbing, pending examination of the brood combs for signs of disease.

5. If any colony appears not to be thriving, and the reason is not already known, examine the brood for signs of disease.
6. Be suspicious of stray swarms. Inspect them for disease once they have become established.
7. Regularly and systematically replace old brood combs in the apiary by melting them down and replacing them with foundation. It is a good idea to replace all frames in the brood box at least every 2 years.

Chalkbrood.



Chalkbrood is a fairly common disease of honeybee brood and is caused by a fungus *Ascosphaera apis*. The fungus grows through the bodies of infected larvae sending fine vegetative thread-like growths into the larval body tissues, eventually overcoming and killing the larvae after its cell have been sealed. The disease spreads as the bodies of dead larvae release sticky spores which adhere to hive components and adult bees. These spores are known to remain dormant and infectious for up to 3 years or more.

It is not regarded as a serious disease in normal circumstances, its effects on the colony being only slight. It is generally present in the majority of colonies at some point in time and can be present in its spore stage without affecting the colony.

Recognition:

The infected larvae take on the hexagonal shape of the cell before shrinking, at which point the adult bees will remove them from the comb. Remains are noticeable on the hive floor or at the hive entrance, looking as though they had been mummified.

The dead larvae which are hard and coloured chalky white are generally removed by adult bees after they have torn down the cell capping's. These 'mummies' will be quite noticeable on the hive floor or at the hive entrance.

Vectors

Millions of Chalkbrood fungi spores are released from dead larvae, and they can exist and remain infectious for a long time. They are sticky and will attach to hive components,

- Beekeepers - Transferring contaminated equipment / material between hives, colonies and apiary sites.
- Robbing - Colonies weakened by Chalkbrood will fall prey to robbing, transferring spores to other colonies and apiaries.
- Drifting - As with Robbing will transfer spores to other colonies.

- Swarming - Swarms can carry the spores with them to new sites where the disease can spread once new brood is produced.

Note: beekeepers are the principal and most rapid means of spreading Chalkbrood Disease.

How to Manage Chalkbrood Disease

Chalkbrood is generally present in the majority of honeybee colonies at one time or another. The spores of *Ascosphaera apis* can be present in a hive and have no apparent effect on it. It is not generally considered a serious disease and the effects on colonies are only slight.

Stonebrood.



Stonebrood is a fungal disease caused by *Aspergillus fumigatus*, *Aspergillus flavus* and *Aspergillus niger*. It causes mummification of the brood of a honey bee colony. The fungi are common soil inhabitants and are also pathogenic to other insects, birds and mammals. The disease is difficult to identify in the early stages of infection. The spores of the different species have different colours and can also cause respiratory damage to humans and other animals. When a bee larva takes in spores they may hatch in the gut, growing rapidly to form a collar like ring near the head. After death the larvae turn black and become difficult to crush, hence the name Stonebrood. Eventually the fungus erupts from the integument of the larva and forms a false skin. In this stage the larvae are covered with powdery fungal spores. Worker bees clean out the infected brood and the hive may recover depending on factors such as the strength of the colony, the level of infection, and hygienic habits of the strain of bees (there is variation in the trait among different subspecies/races). . It is not generally considered a serious disease and the effects on colonies are only slight.

Dysentery.

- Dysentery is a condition resulting from a combination of long periods of inability to make cleansing flights (generally due to cold weather) and food stores which contain a high proportion of indigestible matter. As a bee's gut becomes engorged with faeces that cannot be voided in flight as preferred by the bees, the bee voids within the hive. When enough bees do this the hive population rapidly collapses

and death of the colony results. Dark honeys and honeydews have greater quantities of indigestible matter.

- Occasional warm days in winter are critical for honey bee survival; dysentery problems increase in likelihood if there are periods of more than two or three weeks with temperatures below 50c degrees Fahrenheit. When cleansing flights are few, bees will often be forced out at times when the temperature is barely adequate for their wing muscles to function, and large quantities of bees may be seen dead in the snow around the hives.
- Colonies that are found dead in spring from dysentery will have faeces smeared over the frames and other hive parts.

Chilled Brood.



- Chilled brood is not actually a disease but can be a result of mistreatment of the bees by the beekeeper. It also can be caused by a pesticide hit that primarily kills off the adult population, or by a sudden drop in temperature during rapid spring build up. The brood must be kept warm at all times; nurse bees will cluster over the brood to keep it at the right temperature. When a beekeeper opens the hive (to inspect, remove honey, check the queen, or just to look) and prevents the nurse bees from clustering on the frame for too long, the brood can become chilled, deforming or even killing some of the bees.
- To minimize the risk of chilled brood, open the hive on warm days and at the hottest part of the day (this is also the time when the most field bees will be out foraging and the number of bees in the hive will be at its lowest). Learn to inspect your hive as quickly as possible and put frames with brood back where the bees can cluster on it immediately.

Pesticide Losses.

- Honey bees are susceptible to many of the chemicals used for agricultural spraying of other insects and pests. Many pesticides are known to be toxic to bees. Because the bees forage up to several miles from the hive, they may fly into areas actively being sprayed by farmers or they may collect pollen from 'contaminated' flowers.
- Carbamate pesticides, such as Sevin(R)-Carbaryl ($C_{12}H_{11}NO_2$) can be especially pernicious since toxicity can take as long as two days to become

effective; allowing infected pollen to be returned and distributed throughout the colony. Organophosphates and other insecticides are also known to kill honey bee clusters in treated areas.

- Pesticide losses may be relatively easy to identify (large and sudden numbers of dead bees in front of the hive) or quite difficult, especially if the loss results from a gradual accumulation of pesticide brought in by the foraging bees. Quick acting pesticides may deprive the hive of its foragers, dropping them in the field before they can return home.
- Insecticides that are toxic to bees have label directions that protect the bees from poisoning as they forage. To comply with the label, applicators must know where and when bees forage in the application area, and the length of residual activity of the pesticide.
- Some pesticide authorities recommend, that notice of spraying be sent to all known beekeepers in the area so that they can seal the entrances to their hives and keep the bees inside until the pesticide has had a chance to disperse. This, however, does not solve all problems associated with spraying and the label instructions should be followed regardless of doing this. Sealing honey bees from flight on hot days can kill bees. Beekeeper notification does not offer any protection to bees, if the beekeeper cannot access
- Them, or to wild native or feral honey bees. Thus beekeeper notification as the sole protection procedure does not really protect all the pollinators of the area, and is, in effect, a circumventing of the label requirements. Pesticide losses are a major factor in pollinator decline.

Colony Collapsed Disorder.

- Colony Collapse Disorder (or CCD) is a little-understood phenomenon in which worker bees from a beehive or Western honey bee colony abruptly disappear. CCD was originally found in Western honey bee colonies in North America in late 2006.
- European beekeepers observed a similar phenomenon in Belgium, France, the Netherlands, Greece, Italy, Portugal, and Spain, and initial reports have also come in from Switzerland and Germany, albeit to a lesser degree. Possible cases of CCD have also been reported in Taiwan since April 2007.
- The cause (or causes) of the syndrome is not yet well understood. Hypotheses include environmental change-related stresses, malnutrition, pathogens (i.e., disease including Israel acute paralysis virus, mites, and pesticides such as neonicotinoids or imidacloprid.
- Radiation from cellular phones or other man-made devices, and genetically modified (GM) crops with pest control characteristics such as transgenic maize.
- Some claim that the disappearances have not been reported from organic beekeepers, suggesting to some that beekeeping practices can be a primary factor.

In conclusion

Careful monitoring of your bees is the key to all good apiary management and with regards to pest and diseases should become second nature to the responsible beekeeper. Most are easy to take care of but a few like American and European Foulbrood need to be acted upon as a matter of urgency as these are notifiable diseases. I have not gone into too much details with regards to pest and diseases as they are covered in many books and literature.

Take particular notice and always monitor for Varroa as this pest is the one that will cause you the most trouble. As for the future, no one knows, but always be vigilant for pests such as Small Hive Beetle as it could soon be with us.

We will now move onto to the part where we will work the bees, the time when you go into the hive and get to grips with what is going on and how to manipulate your bees.

Starting from the first yearly inspection right through to preparing your bees for the winter, which they will spend in a cluster.

8. Basic Manipulations.

Before I go into each section of how to manipulate your bees firstly I would like to explain a little of what beekeeping is all about and also a little history of beekeeping.



So what is beekeeping?

Beekeeping (or **apiculture**, from Latin: *apis* "bee") is the maintenance of honey bee colonies, commonly in hives, by humans. A beekeeper (or apiarist) keeps bees in order to collect honey and other products of the hive (including beeswax, propolis, pollen, and royal jelly), to pollinate crops, or to produce bees for sale to other beekeepers. A location where bees are kept is called an apiary.

Depictions of humans collecting honey from wild bees date to 15,000 years ago, efforts to domesticate them are shown in Egyptian art around 4,500 years ago. Simple hives and smoke were used and honey was stored in jars, some of which were found in the tombs of pharaohs such as Tutankhamen. It wasn't until the 18th century that European understanding of the colonies and biology of bees allowed the construction of the moveable comb hive so that honey could be harvested without destroying the entire colony.

Study of honey bees.

It was not until the 18th century that European natural philosophers undertook the scientific study of bee colonies and began to understand the complex and hidden world of bee biology.

Preeminent among these scientific pioneers were Swammerdam, René Antoine Ferchault de Réaumur, Charles Bonnet, and the blind Swiss scientist Francois Huber. Swammerdam and Réaumur were among the first to use a microscope and dissection to understand the internal biology of honey bees. Réaumur was among the first to construct a glass walled observation hive to better observe activities within hives. He observed queens laying eggs in open cells, but still had no idea of how a queen was fertilized; nobody had ever witnessed the mating of a queen and drone and many theories held that queens were "self-fertile," while others believed that a vapour or "miasma" emanating from the drones fertilized queens without direct physical contact. Huber was the first to prove by observation and experiment that queens are physically inseminated by drones outside the confines of hives, usually a great distance away.

Following Réaumur's design, Huber built improved glass-walled observation hives and sectional hives that could be opened like the leaves of a book. This allowed inspecting individual wax combs and greatly improved direct observation of hive activity. Although he went blind before he was twenty, Huber employed a secretary, Francois Burnens, to make daily observations, conduct careful experiments, and keep accurate notes over more than twenty years. Huber confirmed that a hive consists of one queen who is the mother of all the female workers and male drones in the colony. He was also the first to confirm that mating with drones takes place outside of hives and that queens are inseminated by a number of successive mating's with male drones, high in the air at a great distance from their hive. Together, he and Burnens dissected bees under the microscope and were among the first to describe the ovaries and spermatheca, or sperm store, of queens as well as the penis of male drones. Huber is universally regarded as "the father of modern bee-science" and his "Nouvelles Observations sur Les Abeilles (or "New Observations on Bees") revealed all the basic scientific truths for the biology and ecology of honeybees.

Invention of the movable comb hive



Rural beekeeping in the 16th century

Early forms of honey collecting entailed the destruction of the entire colony when the honey was harvested. The wild hive was crudely broken into, using smoke to suppress the bees, the honeycombs were torn out and smashed up — along with the eggs, larvae and honey they contained. The liquid honey from the destroyed brood nest was strained through a sieve or basket. This was destructive and unhygienic, but for hunter-gatherer societies this did not matter, since the honey was generally consumed immediately and there were always more wild colonies to exploit. But in settled societies the destruction of the bee colony meant the loss of a valuable resource; this drawback made beekeeping both inefficient and something of a "stop and start" activity. There could be no continuity of production and no possibility of selective breeding, since each bee colony was destroyed at harvest time, along with its precious queen.

During the medieval period abbeys and monasteries were centres of beekeeping, since beeswax was highly prized for candles and fermented honey was used to make alcoholic mead in areas of Europe where vines would not grow. The 18th and 19th centuries saw successive stages of a revolution in beekeeping, which allowed the bees themselves to be preserved when taking the harvest.

Intermediate stages in the transition from the old beekeeping to the new were recorded for example by Thomas Wildman in 1768/1770, who described advances over the destructive old skep-based beekeeping so that the bees no longer had to be killed to harvest the honey. Wildman for example fixed a parallel array of wooden bars across the top of a straw hive or skep (with a separate straw top to be fixed on later) "so that there are in all seven bars of deal" [in a 10-inch-diameter (250 mm) hive] "to which the bees fix their combs." He also described using such hives in a multi-storey configuration, foreshadowing the modern use of supers: he described adding (at a proper time) successive straw hives below, and eventually removing the ones above when free of brood and filled with honey, so that the bees could be separately preserved at the harvest for a following season. Wildman also described a further development, using hives with "sliding frames" for the bees to build their comb, foreshadowing more modern uses of movable-comb hives. Wildman's book acknowledged the advances in knowledge of bees previously made by Swammerdam, Maraldi, and de Réaumur—he included a lengthy translation of Réaumur's account of the natural history of bees—and he also described the initiatives of others in designing hives for the preservation of bee-life when taking the harvest, citing in particular reports from Brittany dating from the 1750s, due to Comte de la Bourdonnaye.



Lorenzo Langstroth (1810-1895)

The 19th century saw this revolution in beekeeping practice completed through the perfection of the movable comb hive by the American Lorenzo Lorraine Langstroth. Langstroth was the

first person to make practical use of Huber's earlier discovery that there was a specific spatial measurement between the wax combs, later called *the bee space*, which bees do not block with wax, but keep as a free passage. Having determined this bee space (between 5 and 8 mm, or 1/4 to 3/8"), Langstroth then designed a series of wooden frames within a rectangular hive box, carefully maintaining the correct space between successive frames, and found that the bees would build parallel honeycombs in the box without bonding them to each other or to the hive walls. This enables the beekeeper to slide any frame out of the hive for inspection, without

harming the bees or the comb, protecting the eggs, larvae and pupae contained within the cells. It also meant that combs containing honey could be gently removed and the honey extracted without destroying the comb. The emptied honey combs could then be returned to the bees intact for refilling. Langstroth's classic book, *The Hive and Honey-bee*, published in 1853, described his rediscovery of the bee space and the development of his patent movable comb hive.

Evolution of hive designs.

Langstroth's design for movable comb hives was seized upon by apiarists and inventors on both sides of the Atlantic and a wide range of moveable comb hives were designed and perfected in England, France, Germany and the United States. Classic designs evolved in each country: Dadant hives and Langstroth hives are still dominant in the USA; in France the De-Layens trough-hive became popular and in the UK a British National Hive became standard as late as the 1930s although in Scotland the smaller Smith hive is still popular. In some Scandinavian countries and in Russia the traditional trough hive persisted until late in the 20th century and is still kept in some areas. However, the Langstroth and Dadant designs remain ubiquitous in the USA and also in many parts of Europe, though Sweden, Denmark, Germany, France and Italy all have their own national hive designs. Regional variations of hive evolved to reflect the climate, floral productivity and the reproductive characteristics of the various subspecies of native honey bee in each bio-region.

The differences in hive dimensions are insignificant in comparison to the common factors in all these hives: they are all square or rectangular; they all use movable wooden frames; they all consist of a floor, brood-box, honey super, crown-board and roof. Hives have traditionally been constructed of cedar, pine, or cypress wood, but in recent years hives made from injection moulded dense polystyrene have become increasingly important.

Hives also use queen excluders between the brood-box and honey supers to keep the queen from laying eggs in cells next to those containing honey intended for consumption. Also, with the advent in the 20th century of mite pests, hive floors are often replaced for part of (or the whole) year with a wire mesh and removable tray.

So there you have a little bit of what you are and also a little bit of beekeeping history so now we will progress on basic manipulations starting with.

The First Inspection of the year.



As soon as the weather is kind enough for you to go into the hive without chilling the brood and before the colony has a chance to build up, you must go into the hive and check.

- To see if the queen is alive and well and check to see that she is laying and importantly at this stage of the season to see if she is marked. If this is not done now you will find it very difficult to find her when the hive is full of bees.
- Check on the brood frames and if any are damaged or old and dirty, sterilize and replace with new foundation.
- Start to feed the bees. This will encourage the queen to start to lay. You can also give pollen substitute at this stage, again to encourage the queen to start to lay.
- Remove any dead bees from the floor.

Procedure.

Firstly make sure you have all the equipment with you in your Gubbings box and that your protective clothing is all sealed in. As stated in the previous chapter, there is nothing worse than going into the bees and finding that some equipment is missing or you have holes in your bee suit. You will need in particular your queen marking cage and your marking pen, as this is the time to mark your queen if, for instance she has been superseded or is just unmarked.

The hive is now empty in comparison to what it is going to be like in another month or so when the queen starts to lay, so this is the opportune time to mark her.

Take off the lid and Crownboard. Remove a frame from the end so as to give you room to work put in a little smoke to quieten the bees down. A little in the entrance and a little on the top. If you have any candy on, you can take this off also. You are now ready to go into the hive to see how things are.

The first job is to find the queen and mark her up as the bees will be a little quieter now compared to if you leave it until later. Hold the cage over the queen and move her away from brood before pressing it into an area of stores or empty cells. With your marker ready in your right hand gently press the cage down just enough to hold the queen still, mark her thorax and

lift the cage off straight away. Practising on some drones can help you acquire the knack of holding a bee still.

Another and better way when you become more confident is to pick her from the comb by the wings using your right hand. (You can't do this wearing gloves.) Transfer her to your left hand and hold her thorax between your finger and thumb. Never hold her by her abdomen. Mark her on the thorax and after half a minute, so as the mark is dry release her back onto the comb. Again practise on some drones to gain confidence in handling bees before attempting to mark a queen.

Once the queen is marked you can then look through the hive for the following.

- Check the brood frames and if any are damaged or old and dirty, sterilize and replace with new foundation. This will give the bees a good start to the year and get rid of any disease that may be in the frames and foundation.

Have a look if there is enough brood and eggs about, this will indicate that the queen is ok. Identifying eggs is the most important part of the beehive inspection for the new beekeeper. But many new beekeepers find it really difficult to see eggs! So here are some tips of what eggs look like inside the cells. Eggs look like thin grains of rice. There should be one per cell, laid in the middle of it. If you have more than one per cell, you have laying workers or a new inexperienced queen - consult an experienced beekeeper about this situation. The best way to see eggs is to hold the frame at an angle, not vertical and not horizontal but tilted up toward the sky at about a 30-degree angle. Have the bright sun shining over your shoulder. And (and I wish someone had told me this!) hold it slightly to the side of you so that the shadow pattern of mesh from your veil doesn't obscure the eggs! If you hold it right in front of you, the shadow of your own veil can get in the way of identifying the eggs. Using reading glasses or a magnifying glass can also help. I stand there and tilt the frame back and forth and experiment with the angle of the sun and of the frame until I see them. Also, looking toward the bottom centre of a frame is often a good place to positively identify eggs.

- Check for any parasites or pests - mites, wax moth larvae, foulbrood, etc.
- Check to see if the bees have enough food and enough pollen.
- As you inspect each frame, put it into the open space left by the first frame you removed. Push each frame to the one in front of it as you replace it - gently! You don't want to squash any bees. Using a bee brush or smoke helps move the bees out of the way, especially at the frame ears where they are likely to get squished.
- Inspect frames in order and don't change the order of the frames during inspection. When you get to the final frame, push the whole set of frames together, using your hive tool, as one single unit, making space in the front for the first frame. Replace it, then use your hive tool to even up the space on either side of the first and last frames so that the set of frames is centred in the box.
- Put the crown board back onto the top of the hive.
- I would at this time also put on some syrup feed to give the bees a kick start. You can also put on some pollen substitute as this will also get the queen laying.
- What we are after is the queen laying as soon as possible so as when the honey flows start there will be plenty of bees in the hive to bring in the pollen, propolis and nectar.

Here are some recipes for making sugar syrup and pollen substitute.

Making sugar syrup.

To make sugar syrup use white granulated sugar. With modern production methods it makes no difference if it was sourced from cane or beet.

Do not use brown or raw sugars as they contain impurities.

The syrup should be made up in the proportion of 1 kg of granulated sugar to 630 ml. of water or 2 lb. sugar to 1 pt. of water. There is no need to boil the mixture but using hot water helps. Stir regularly to remove the air bubbles and dissolve all the crystals. When fully dissolved the mixture is clear and a very pale straw colour.

Pollen substitute patties recipe (no pollen):

1.5 cups (8oz.) fat-free soy flour

1.5 cups (12oz.) granulated sugar

.5 cup (1oz.) Brewer's yeast

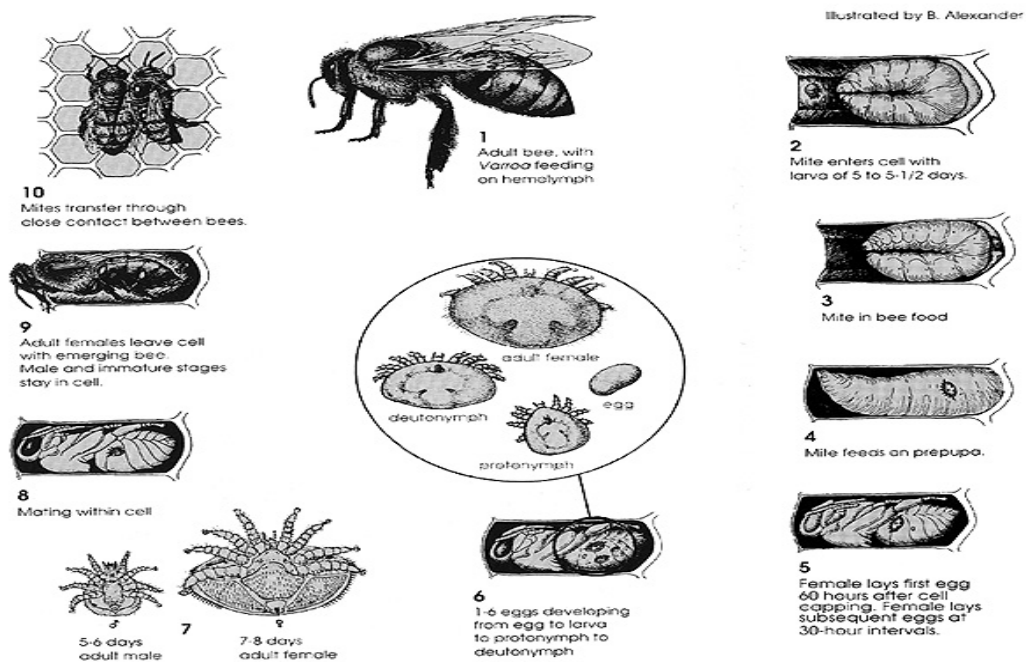
1.5 cups (12oz.) Sugar Syrup (2:1) or your honey

NOTE: You can also use regular soy flour. Add water as needed to mix. In very warm climates it may be necessary to add an oil to prevent drying.

That is about all you can do for your first inspection. If the weather is cold and the bees are not working just keep feeding them until times are more favourable.

I will now move onto the next part which is Varroa Control

Varroa Control.



Varroa infestations are often missed by beekeepers until the infestation is severe. It is therefore important to regularly monitor for the pest and to be able to assess when the infestation is likely to have an impact on the colony. It can thus be seen that the key to successful Varroa control is knowing how many mites are present in a colony and when to take appropriate action. Let me explain how to calculate Varroa populations. There are two accurate methods. Both require some time so a quick assessment method has been included at the end of this sheet. You must remember that the 'quick guide' is not an accurate assessment.

Assessment.

Method 1.

Natural Mite Mortality.

The number of mites recovered from floor debris can give an indication of the mite population. The system is accurate in the winter and summer but during March, April, September and October the results are less accurate.

To use this method-

- 1) Use a Varroa screen floor or a tray fitted with mesh screen.
- 2) During summer collect debris for at least 7 days.
- 3) During winter collect debris for a longer period.
- 4) No treatment should be carried out during the sampling period.
- 5) Collect the debris and count the number of mites. Divide this figure by the number of days the sample was taken over and you have a daily mite fall figure.
- 6) Multiply the daily mite fall figure by one of the following

Winter i.e. November to February x400

Summer i.e. May to August x30

March, April, September and October x100*

** Remember this result will be approximate only.*

Method 2.

Drone Brood Uncapping

- 1) Select an area of sealed drone brood at an advanced stage. ie.purple eye stage.
- 2) Insert a honey uncapping fork under the capping's and lift out the pupae.
- 3) Mites present will be clearly visible on the pupae. Count the number of pupae with mites on.
- 4) Calculate the number of sealed drone cells present in the colony.
- 5) Divide the number of infested drone pupae by the number of drone pupae sampled.
- 6) Multiply the result by the number of sealed drone cells in the colony and multiply that figure by ten to give the mite population

N.B. This method becomes more accurate with a large sample, which should be in the region of 100 pupae.

Varroa Treatment Thresholds.

Treatment thresholds are variable according to where you live in the world, climate, size of colony, the amount of brood, drone brood, number of brood cycles, etc., Collapse levels can vary considerably. Research has shown that colonies can collapse with 1,000 mites yet others survive with far greater numbers. Current understanding shows that these differences are invariably caused by the presence of other factors, often being the presence of other bee disease such as various virus conditions or Acarine *acarapis woodi* a Tracheael mite. These variations and associated conditions are regularly seen in Southern England.

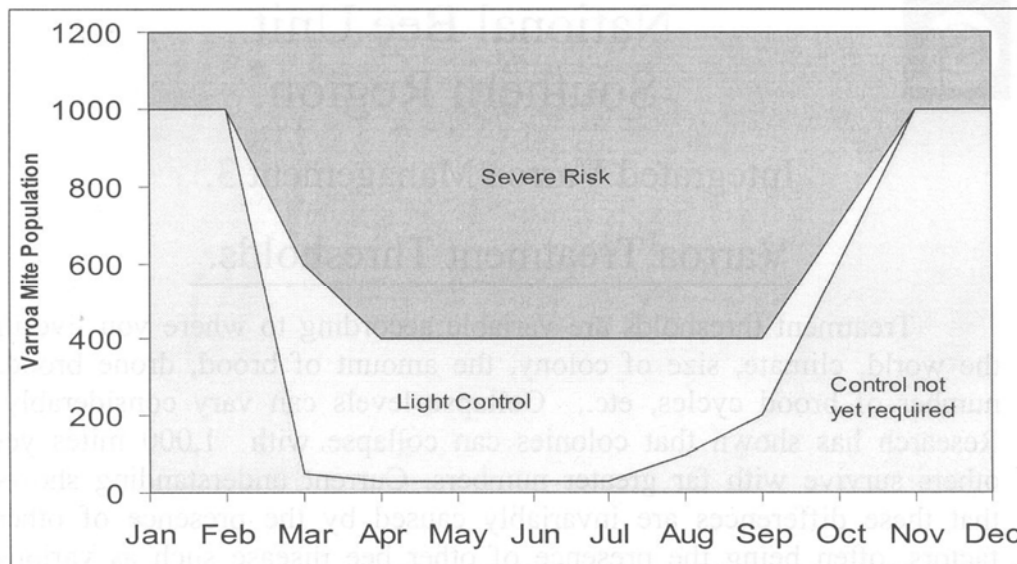
The key to successful Varroa mite control is knowing the mite population level within a colony and keeping it below the level at which damage may occur.

Set out overleaf are two graphs which have been drawn up to reflect a typical honey production colony in Southern England. It presumes a long period rearing brood and a drone brood level of 5%. The graphs show mite levels that are currently considered acceptable within a colony. These levels are set lower than previously as a result of further research data being available. Many beekeepers may consider the levels set are too low but they will keep colonies safe and productive.

Many beekeepers report that colonies that have given high yields of honey often succumb to Varroa in the following winter. The reason for this is a rapid build-up of Varroa mites due to more brood being available within the colony and more brood cycles occurring... The beekeeper fails to notice the problem and the colony collapses. It is therefore a key element in any Varroa control system to be aware of mite levels in order that appropriate action can be taken at the right time.

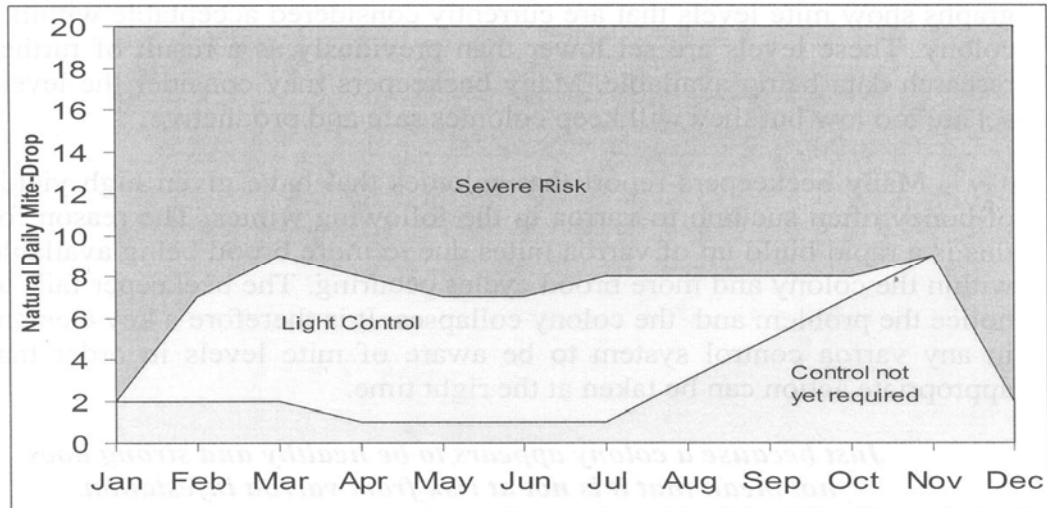
Just because a colony appears to be healthy and strong does not mean that it is not at risk from Varroa infestation

Graph 1



The upper band, marked 'Severe Risk' indicates where the colony could be at severe risk requiring effective Varroa control. **The central band**, is where a suitable non-chemical control should be taken to reduce population levels to the 'No Control' band. **The lower band**, marked 'No Control' is the level of mites which, without infestation from other sources, will require no controls to be applied before the following spring

Graph 2



So what do we do if we find severe amounts of mite in our hives? The answer is that we have to treat, otherwise we will be in danger of losing our bees. Treating comes in a few forms which I will explain.

Treatments and Control.



Medication options for Varroa mites.

There are a few effective and approved *miticides* (chemicals that kill mites). When you confirm Varroa mites in your colony, you must immediately treat with one of these treatments by carefully following the directions on the package.

Because Varroa mites can develop a resistance to these medications, it is prudent to alternate between two or more of these from one season to the next.

Apistan (fluvalinate)

Apistan is packaged as chemical-impregnated strips that look kind of like bookmarks. Hang two of the plastic strips in the brood chamber between second and third frames and the seventh and eighth frames. You're positioning the strips close to the brood so the bees naturally come into contact with the miticide they contain. The bees will brush up against each other and transfer the fluvalinate throughout the hive.

Never treat your bees with *any* kind of medication when you have honey supers on the hive. If you do, your honey becomes contaminated and cannot be used for human consumption. Feeding medicated honey to the bees is, however, perfectly okay.

CheckMite+

Some mites have developed a resistance to Apistan, so new miticides have entered the market. CheckMite+ is a product manufactured by the Bayer Corporation (of aspirin fame). Like Apistan, it also consists of strips impregnated with a chemical miticide. It's tricky to use safely. New beekeepers should steer clear of CheckMite+ until they gain experience.

Mite-Away II (Formic acid)

Formic acid is available in gel packs, but it is caustic and tricky to administer.

Apiguard (Thymol)

Apiguard is a natural product specifically designed for use in beehives. It is a slow-release gel matrix, ensuring correct dosage of the active ingredient Thymol. Thymol is a naturally occurring substance derived from the plant thyme. It is easy to use and much safer than formic acid or coumaphos. You might try alternating between Apistan and Apiguard if you need to treat your bees for Varroa mites

Natural options for treating bees with Varroa mites

You don't always have to use chemicals to deal with Varroa mites. Integrated pest management (IPM) is the practice of controlling honey bee pests with the minimal use of chemicals.

- **Use Drone Comb to Capture Varroa Mites.**

Bee suppliers sell a special "drone" foundation that has larger hexagons imprinted in the sheet. The bees will only build drone comb on these sheets. That's useful, because Varroa mites prefer drone brood over worker brood.

By placing a frame of drone comb in each of your hives, you can "capture" and remove a many mites. Once the drone cells are capped, remove the frame and place it overnight in your freezer. This will kill the drone brood and also the mites that have invaded the cells.

Then uncapped the cells and place the frame (with the dead drone brood and dead mites back in the hive. The bees will clean it out (removing the dead drone brood and mites). The cells will get filled again, and you repeat the process.

- **Powdered Sugar Dusting to Control Varroa Mites.** This involves dusting the bees with powdered sugar (note it's best to find a powdered sugar without added corn starch, although some claim this is not so critical. Play it safe and ask your bee supplies for a "pure" powdered sugar).

Here's the process:

Sift a pound of powdered sugar using a baking flour sifter. Do this twice to ensure no lumps. This should be done on a day with low humidity.

Put the sifted sugar into an empty (and cleaned), baby powder container (alternatively you can improvise your own container).

Smoke and open the hive.

Remove frames one by one, and dust the bees with the sugar.

Avoid dusting any open cells.

Put the dusted frame back into the hive and repeat this process with each frame.

When done, but a little extra dusting along all the top bars.

This should be repeated once a week for two to three weeks.

Always have an open mesh floor on your hives. Leave out any drawers you may have fitted so as any natural mite drop will drop on the ground under the hive. The mites will not be able to climb back into the hive and will die.

Looking for problems within the Hive.



Whenever you look into your bees, you should carry out what operation you have to do and concentrate on the job in hand until it is all complete.

When you have done this task and on all other occasions it is a good rule to check through the hive to see that all is in order.

What to look for are

- Is the queen laying ok? You do not need to find the queen as you can tell by looking to see if there are eggs and larvae present.
- Is the brood pattern ok? This will tell you if the queen is ok or if she is failing.
- Check for signs of any queen cells. This will warn you of any swarm preparations within the hive.
- Check for any signs of disease. You will find out how to look for any signs of diseases and pest in Part 4 of this course.
- Check to see if any old or damaged frames need replacing.
- Check to see if stores in the brood box are adequate, if not **FEED**. If getting congested give them more room by either spitting the hive or taking out stores and adding new brood frames or putting on supers.
- Check to see if more supers need adding.
-

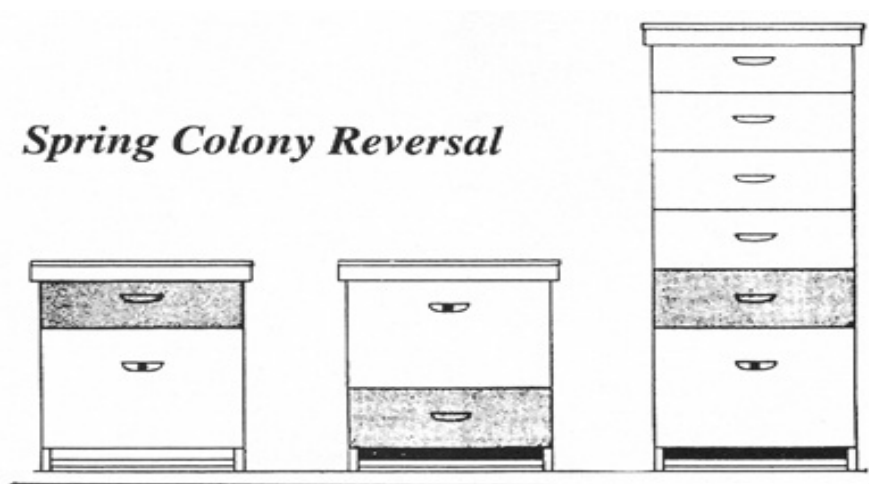
You do not need to do all these things, every time you go into the hive as it will take too long and will stress out the bees and make them angry. It's more a matter of common sense which you will gain from experience. Doing a few checks every time and learning to look for signs of trouble is the secret to good hive management.

One thing that you must remember when looking for any problems, and that is to **write it down in your record book**. If you have a few hives it's very easy to get yourself confused and forget things.

If you do find anything, act on it right away, don't leave it until later. The bees will carry on regardless which could be too late for the beekeeper who thinks on the lines of never mind it will be ok another day. If you are unsure ask someone or if you suspect any disease, call the regional bee inspector. They won't mind, it's their job and other beekeepers are always willing to help out a beginner.

Take your time when going through the bees as it's a nervous time when you are starting out, you will bang things about if you rush which will upset the bees who will in turn attack you

Basic Swarm Control.



- All bees **HAVE** to swarm and there is no way you can stop it.
- It is the only way that bees can multiply and if they did not swarm, the whole bee population of the world would die out.
- What we, as responsible Beekeepers have to do is to try to control the swarms by artificial swarming methods.
- When a swarm occurs. All the flying bees leave the hive, so all honey production stops.
- The bees gorge themselves with honey so that most of your honey is gone.
- If you lose a swarm it's a loss to you but also the swarm may not survive due to the threat of Varroa and starvation.
- Swarms can cause problems to neighbours and non-beekeepers.
- There are quite a number of Swarm control methods such as the Shook Swarm Method, Snelgrove Method, Pagden Method, Demaree Method, Taranov Method and others. It really is a matter of choice
- **But never, ever forget that whichever method you use, it must be done and is a very important part of a beekeepers year.**

What I will show you are 2 methods which are very easy and aimed at the beginner.

Before you need to do any swarm management controls you will first have to look at the colony and assess if the colony is ready for swarming. The way to do this is as follows:

The end of April to early May is a good start for your inspection monitoring but this will depend on the climate and your colonies condition at the time.

When checking for swarming preparations look always for the following things.

- Drone brood on the comb and a lot of mature drones flying. Monitor for the increase of drone brood.
- Does the queen look thinner than the last time you look at her as the workers will slim her down ready for swarming.
- Is there absence of eggs in worker and drone cells as the queen will stop laying in readiness for swarming?
- Look for queen cells, they will usually be found along the top, bottom and side edges of the comb.
- The presence of eggs in queen cells.
- Sealed queen cells, these can trigger a swarm 8 to 9 days after the egg is laid if the weather is good.
- Make sure your **queen is marked up** and if you wish to clip her do it now.

Swarm Management options.

If you have done the above and identified that the colony is about to swarm you have 2 options on what to do.

1. Swarm management with **no** increase in colony numbers.
2. Swarm Management with **an increase** in colony numbers.

In both cases you will need to make an artificial swarm. The artificial swarm is the colony that contains the original queen. Whist the parent colony (original colony) is the colony which the new queen cells will be raised and new queens will emerge and mate.

Have all the equipment you require ready in your apiary and read through from below which method you want to do, make notes and what you are doing. Have a couple of dummy practice runs to know where to put things and in what order. ***Make sure that the queen is marked. This should have been done at your first inspection a month or so ago.***

First of all you will have to make up an artificial swarm. And here is how to do it

Making up of the artificial swarm.

- Gentle smoke the entrance of the hive and stand back for a couple of minutes.
- Remove the roof gently and smoke over the crown board, and put the roof to one side of the hive about a metre away.
- Remove any supers and put at one side on top of a crown board, cover them up with a cloth to keep the bees quiet and in the supers.
- Place the original brood box on a spare crown board.
- On the original location where you have just removed the brood box put a floor and an empty clean brood box.
- Go back to the original brood box you have at the side, containing the queen and gentle smoke over the frames. Make sure you only use a little smoke as if you use too much you will panic the queen and she will move off the frames into a recess of the hive and will be hard to find.
- Go through the frames until you find ***the marked queen.***
- Use a queen marking cage to hold her on the frame whist you check the frame for any queen cells.
- If this frame is the only one in the hive with queen cells move the queen onto another frame. ***On no account must she be on a frame with any queen cells.***
- Place this frame with the caged queen and bees into the new brood box on the original site and let her out of the marking cage.
- Make up the rest of the brood box with drawn clean comb or foundation.
- Replace the queen excluder, supers, crown board and put the roof back on.

Most of the flying bees will go back to the original site which now contains the artificial swarm. Feed this artificial swarm with light syrup unless there is a good honey flow in progress.

With this now done you are now ready to do your

1. **Swarm management with no increase in colony numbers.**
2. **Swarm Management with an increase in colony numbers.**

So here we go.

Swarm management with no increase in colony numbers

The objective here is to keep up the honey production of the colony by keeping the foraging bees as a single colony rather than losing them to a prime swarm and after casts. Also by this method the rearing of brood continues uninterrupted, the artificial swarm will continue to forage for nectar and the colony has been re-queened.

- Move the parent colony close to one side of the artificial swarm you have just made.
- Select 2 unsealed queen cells containing larvae and destroy the rest from all of the frames.
- Mark with drawing pins the tops of the frame or frames that have the queen cells you have just selected.
- Calculate the number of days which you expect the queens will have emerged from the queen cells and also the number of days that surviving queen will have mated and will be laying. This can be up to 21 days after the date she emerged from the queen cell: if after this time you look into the hive and there is no sign of any eggs, the queen will have been lost on her maiden flights or maybe have been damaged in some way or another. You will also be able to tell with the attitude of the bees if she is there or not even if you cannot see her.
- When this new queen is laying you can unite this colony with your artificial swarm. But you must first find the queen in the artificial swarm (the original queen) and get rid of her, that unless she is a valuable one and you wish to use her for breeding, in which case you can transfer her to a newly made up nucleus colony.
- Unite the 2 colonies by newspaper method, by this I mean place a newspaper which is been perforated in a few places which will enable the bees to chew through and so open up a contact between the 2 colonies. The odours will mix and the colonies will unite. The colony with the queen should be at the bottom and you can use a queen excluder to stop her going into the top box, but this rarely happens.
- Put on the queen excluders and supers and leave until all the brood in the top brood box as hatched out. Then you can shake the bees down and take away the top box, putting any stores etc. down in the bottom box.

Swarm Management with an increase in colony numbers

This method lets you produce 2 nuclei (nucs) which you can grow into 2 new colonies.

- Put 2 nucleus boxes with their floors on the roof of the artificial swarm to have just made up. Make sure that the entrances face opposite directions.
- Go through the combs of the original colony and split the colony into 2 equal parts with each part having two unsealed queen cells.
- Remove all the other queen cells.
- Put each half part into each of the nuc boxes.
- Mark the frames which contain the queen cells with drawing pins.
- Replace the crown boards and the roofs of the nuc boxes.
- Again calculate the times for which the virgin queen will have emerged, mated and will be laying eggs.

- Once the queens are laying and are getting on with, they can be transferred to full brood boxes and moved to another site more than 3 miles away for a week and then brought back to continue their development.

There are many other variations to the above methods which I will not go into on this paper. These include the Curry Method, The Snelgrove Method, Pagden Method, Damaree Method and the Taranov Board to name a few. There will also be other methods that some beekeepers have thought up for themselves which I am sure work well. The above methods are the basic ways of swarm control which are, I suppose the work horse way of doing and have been handed down over the years and to me are a sound basis for the beginner.

The Curry method of swarm control is another good method. Easy to do and very effective.

The Curry Method of Swarm Control

By T.I Curry, Penrith

This method which if done correctly, enables you to: -

1. Go on holiday for 6 weeks at the height of the swarming season, if you wish without losing a swarm.
2. Obtain a good crop of Blossom Honey.
3. Automatically provide a new current year mated Queen to be very easily united **directly** i.e. **without** the need of the newspaper method.
4. Produce **extremely** strong colony of Bees **of foraging age** for the Heather- I have never failed to obtain even in very poor seasons, because there are sufficient Bees of the **right age** to take advantage of the short period of the yield. My colonies are so strong that they will even produce excellent sections at the heather moor.

Additional equipment required for each hive.

1. Spare Brood Box **with 6 frames**- they can be with Foundation but preferably built out and better still with some Honey.
2. Double Skin Screen Board with a flight entrance of 2". The gap between to 2 skins should be 0.5inch and a 9 inch square hole square should be cut should be cut out of the centre of each skin with the holes covered with perforated zinc. The gap is to prevent communication between the colony above the screen board and the colony below (described later) and the perforated zinc is to enable both colonies to have the same odour which facilitates the direct uniting as referred to in 3 above.
3. Wide Dummy Frames- wooden frames covered with hardboard- to fill up the vacant space in the spare brood box, **but leaving room for one spare frame.**

Method

1. Where the colonies are strong, either with or without started Queen Cells- but preferably between the 20th and the 27th of May, to provide the bees for the right age for the heather-take off the supers and the Queen excluder
2. Remove the original Brood Box.
3. Place a new Brood Box on the original flight board.
4. Go through the original Brood Box, find the frame with the Queen on it, **(she will be more easily found if she has been already marked. But if not mark her now)**
5. After ensuring that there are no Queen Cells on that frame, place it with the adhering bees into the centre of the 6 frames of the new Brood Box on the original stand.

6. Put on the Queen Excluder and Supers.
7. Put on the special Screen Board **with the entrance to the front.**
8. Put the **original** Brood Box above the screen board.
9. Go through the original Brood Box and:-

(a) If Queen Cells are already started, select a good one which is still open, (so you know that there is a Queen Larvae in it), in a protected position if possible, e.g. in a recess in the bottom corner. Do **NOT** shake this frame whilst you are searching for any more Queen Cells, but examine it carefully by moving your fingers or blowing on them. Mark to position of the selected cell by inserting a drawing pin in the top of the frame above the perpendicular line of the Queen Cell. Then and only then shake all the Bees off all the other Frames to ensure that there are no other Queen Cells. This will cause all the Bees that are capable of flying to take to the air and those which are orientated **will re-enter the new brood box** and re-join the Queen. This will be the equivalent of a very strong swarm because it will have all the flying bees instead of just some of them. The original Brood Box will have no young mouths to feed and will have a foraging force which will continue to store Honey in the Supers with renewed vigour. It is common knowledge that nothing works harder than a swarm.

(b) If there are no Queen Cells started, proceed exactly as above with the exception that (1) there will be no Queen Cell to be marked with a drawing pin on top of the frame. (2) Shake the bees off **all** of the Frames when looking **carefully** for queen cells.

10. 6 or 7 days later – NO MORE go through the top box **carefully**.

(a) Check to see if the Queen Cell marked with a drawing pin as described in 9(a) is sealed and undamaged, and then **carefully** destroy any other Queen Cells on that Frame. **(DO NOT SHAKE IT).** Then shake all the bees off all the other Frames and destroy any Queen Cells on these frames.

(b) If there were no Queen Cells found as describes in 9(b), **carefully** examine all Frames before shaking **any** of them and select a good Queen Cell, **which is still open** and mark its position with a drawing pin on the top of the Frame. Do not shake this Frame but remove the Bees with the fingers or blowing on them to enable you to find and destroy any other Queen Cells. (NB) The reason for selecting a Queen Cell which is still open is because the Queen Cells are not sealed until the 8th day which means that if it is still open on the 6th or 7th day it will have had the full Queen treatment from its very early stages- Queen Cells which are already sealed on the 6th or 7th day must have been started from eggs are larva more than 2 days old and would make inferior Queens.

(c) Now shake all the bees off the remaining frames and destroy all other Queen Cells. **There cannot (if you have done all the foregoing efficiently)** any eggs or larvae young enough for further viable Queen Cells to be made, so you can go on holiday for 6 weeks if you wish and your swarm control is over for another season. No more weekly inspections which are a waste of time in any case if you happen to miss a Queen Cell., that is unless you are checking for Varroa and carrying out Integrated Pest Control (IPC) but if you check for Varroa with the use of an open mesh floor and a catching drawer and the count is low you need not go into the Hive. Regular inspections only stresses your bees and (your neighbours) and also interrupts Honey gathering.

(11)

(1) At least 3 or 4 days before going to the Heather, go through the top Brood Box to ensure that the new Queen is laying intact. If not already marked as described above, mark her **NOW** so that she can be easily found when repeating the system next year or if you need to identify her at some later stage or in spring next year to see if she is present or if she has been superseded or lost over the winter etc.

(2) Take off the Top Brood Box, Supers and Queen Excluder.

(3) Go through the bottom box and **destroy any Queen Cells** (I have never found any). Remove the wide Dummy Boards.

(4) Give away or destroy the old Queen (**essential**) you will now appreciate why she should be marked in the earlier paragraph No 4. Remove all Frames not containing Brood Larvae or Eggs and **keep covered to prevent robbing**. These with similar Frames from the top box will provide the Frames as suggested earlier in No 1. Leave this Brood Box in position on the floor and put all the remaining Frames in it to the side of the box.

(5) Go through the former Top Brood Box and remove all Frames not containing Brood, Larvae or Eggs, (**making sure not to remove the New Queen**) I play it safe by placing on a Frame in a separate closed box when finding her as described in 11(1) above. You can also use a Queen Cage to keep her on the Frame but be careful not to damage her. Keep them covered to avoid robbing.

(6) Put at least 2 Frames of Brood, Larvae and Eggs directly into the Brood Box on the floor, followed by the frame with the new Queen and Bees, followed by more frames of Bees, Eggs and Larvae from the Top Box. This ensures that the new Queen is surrounded initially by her own offspring.

(7) Shake or brush in (with a Goose Feather if available) the Bees from the empty Brood Box.

(8) Put on the Queen Excluder and Heather Supers if going to the Heather or blossom Supers for finishing.

These Supers will need to have plenty of room in them for the larger quantity of bees from 2 laying Queens. You can also with new Brood Box on the original flight board, where you will just have the old queen and all the flying bees, treat with Oxalic Acid. This is the only time that this treatment can be done in the summer months.

Splitting and making another colony.



You can create a second colony from your existing colony. You don't even have to order another package of bees! Free bees! Ah, but here's the dilemma! You'll need a new queen for your new colony. Strictly speaking, you don't have to order a new queen. You can let the bees

make their own; however, ordering a new queen is simply faster and more fool proof. Or if you want to get really adventurous, you can raise your own queen.

To make two hives from one, you first need a strong, healthy hive. That's just what you hope your hive will be like at the start of its second season — boiling with lots and lots of busy bees. The procedure is known as *dividing* or *making a divide*.

Dividing not only enables you to start a new colony, it's also considered good bee management; dividing thins out a strong colony and prevents that colony from swarming.

The best time to make a divide is in the early spring about a month before the first major nectar flow. Follow these steps in the order they are given:

- Before you can think about splits, you need to think about equipment. This may seem obvious, but it's a helpless feeling to discover your colony is ready to swarm and you don't have a place to put a split. So first things first: make sure you go into swarm season with some extra boxes and frames.
- Once queen cells appear on the bottoms or sides of your brood combs, swarming is imminent. You can either move the swarm cells out of the hive or move the queen out of the hive to make the split.
- I prefer to move the old queen into a new box and leave the swarm cells where they are because this simulates actual swarming. So here is what I do:

Catch the queen. You don't have to actually confine her, but it makes things a little easier if you do. In any case, you have to know where she is.

Divide the frames between the old hive and the new hive. For example, if you have 10 frames, put 5 in each hive. Try to equalize brood, pollen, and honey so both hives have some stores. However, make sure the old hive has at least one swarm cell and the new hive has the queen.

Arrange the frames so that brood is in the centre of the box, just outside the brood put frames containing pollen. Add at least one frame of honey.

Fill out the rest of the box with frames of empty comb or foundation or starter strips.

Now you have two five-frame colonies, one with a queen and one with a queen cell. Each hive now "thinks" it has swarmed.

The nurse bees in each hive will stay with the brood, but the foraging bees will return to the old hive. So, for a few days, the old hive will appear very busy compared with the new one. The new one will get busier as young bees hatch and nurses become foragers.

Since it will be a few days before lots of stores are brought into the new hive, make sure it has plenty of honey and pollen. One way to speed things up is to make sure the new hive has mostly capped brood—it will hatch much sooner than uncapped brood.

To prevent this new hive from swarming it is best to cut off any remaining swarm cells. Again, this simulates a true swarm because there would be no swarm cells in a newly colonized hive.

More than one swarm cell in the old hive is okay. Again, it simulates actual swarm conditions where several swarm cells are left in the original hive. The first virgin queen out will most likely kill the others.

Once the queen cells are capped in the old hive it can take up to three weeks for the queen to mature, mate, and start to lay eggs. If you don't see eggs after that time, you may have to provide a queen, a queen cell, fresh eggs, or very young larvae to keep the colony alive.

Basic Re-Queening.



- There are a few reasons why you should re-queen a hive. The main reasons are as follows.
- If you have a very bad tempered set of bees in a particular hive, some beekeepers say destroy the hive. I say they talk a load of rubbish. What should be done, is to re-queen the hive from a stock of your own quiet bees or you can obtain a queen from a known stock of quiet bees.
- A word of warning. Forget bees that are imported from abroad. They will be ok for the first year but after that they more that not will become worse than the ones you have re-queened. Also you have a good chance of bringing into the country pests and diseases. That's how Varroa arrived, along with *Nosema cerana*.
- Another reason is that you may have lost your old queen and the hive condition is such that the bees are unable to make another queen for themselves.
- Also the queen may have become a drone layer which again is the sign of an old or failing queen.

There are 2 basic ways to re-queen. One is to introduce a new queen and the second is to requeen using suitable queen cells. The introduction of queen cells from another hive is basically the same as doing the curry method and splitting a colony as shown previously.

Method.

As a beekeeper, you must understand several important factors regarding your queen. The queen is the most important bee in the entire colony. She lays the eggs. She determines the overall health and productivity of the colony. She even influences how hygienic her daughters are toward mites and disease. And though she may live four or five years, she will be at her best only for one to two years. After that, she needs replaced. Out of all the hives I have lost over the years, yearly requeening would have saved most of my hives.

You should seriously consider requeening your hive once a year. You will have to determine where to buy your queen, from stock that you prefer. I don't like buying queens from others. Even though there are many impressive breeder queen suppliers, you just really never know the quality of your queen until she is released and goes to work in your hive.

I'll address queen stock in a moment, but for now, let's consider requeening a hive. Who? When? What? Where? And Why? These are questions surrounding requeening a hive. Beginners seem to be reluctant to requeen, because most beginners do not have the confidence yet to open a hive, meticulously search every frame until the queen is located, grab her in your hand, and put the hive back together quickly. But, it really isn't all that bad. Let me give you some tricks of the trade.

Simply put, here's how to requeen a hive. Find the old queen if the hive still has a queen, remove her and introduce the new queen. That's it. Sounds simple, and sometimes it is just that simple. However, more often than not, it takes a bit more work.

We've talked about why to requeen, not let's talk about when. September is often viewed as the best month to requeen because it allows your young queen time to become well established with her hive prior to winter. In fact, she may lay some good brood of winter bees. Winter bees live a month or two longer because they are not working much during their lifetime due to mainly riding out the winter in a cluster. And, when spring arrives, a new queen will be ready to lay as the weather warms up. However, requeening in September is more difficult because during September there is not a heavy nectar flow and bees more readily accept a new queen during a heavy nectar flow.

I prefer September because it produces the most spring benefits. However, it also carries with it the most liabilities. A liability might be that they bees will not accept her, and the weather may keep me from inspecting to insure she is accepted and laying well. Thus, there is a risk in removing an old laying queen for a new one, because the new one could be a dud, worse than the older one. No queen in September means no winter bees...you get the picture. It's worth the challenge, but it is a challenge.

HOW TO SPOT THE QUEEN.

A marked queen helps you spot her, and lets you know if she has been replaced. Learn to spot the queen by those around her.

When looking at a frame full of bees, if you can't find the queen try looking over the entire frame and observe how the bees are behaving.

Two things signal a queen. First, she is often encircled by bees. Not always, but often enough that you should look for this circle of bees. Secondly, bees get out of her way. In addition to these two signals, I've even tracked her down by her occasional sound she sometimes makes. It's almost like a faint sound of a smoke detector only more rapid and with a slight buzz. This is called piping. It is most common when a queen is newly released and it not heard so much from mated, established queens unless there is a new queen being introduced in a hive that already has a queen and the two are politicking for followers.

Look for freshly laid eggs. Another trick that I use is to carefully examine the unsealed brood cells. I look for freshly laid eggs. Ah, then I know the queen was at that cell not too long ago. It's sort of a bread crumb trail. I rarely find queens on full combs of honey or pollen, but mainly only on opened cell comb, that's just right for laying eggs.

I Found Her And Want To Replace Her...Now What Do I Do?

Normally, a queen will not sting. Unlike the working bee, the queen does not lose her stinger but it is rare for her to sting the beekeeper.

Usually if you are removing a queen to requeen a hive you probably do not want to use that queen in a nuc or another hive. You are requeening her usually because she is too aged or substandard. Let me put it nicely. She's done. I'll leave it to your creative thinking as to how you wish to end her life.

Timing is important. You need to have your replacement queen on hand before you kill the substandard queen. Once you remove the old queen, wait at least 24 hours before introducing the new queen. You may even wait up to 2 days. However, remember that your bees will know that they are queenless and will begin to resolve their problem by raising their own queen from a fertilized egg. This is one way to requeen a hive, just allow the bees to raise their own queen. In doing it this way, you have to wait three to four weeks before she will emerge, mate and begin laying. And remember that by raising your own queen she will have most of the characteristics of her mother. That may or may not be what you want.

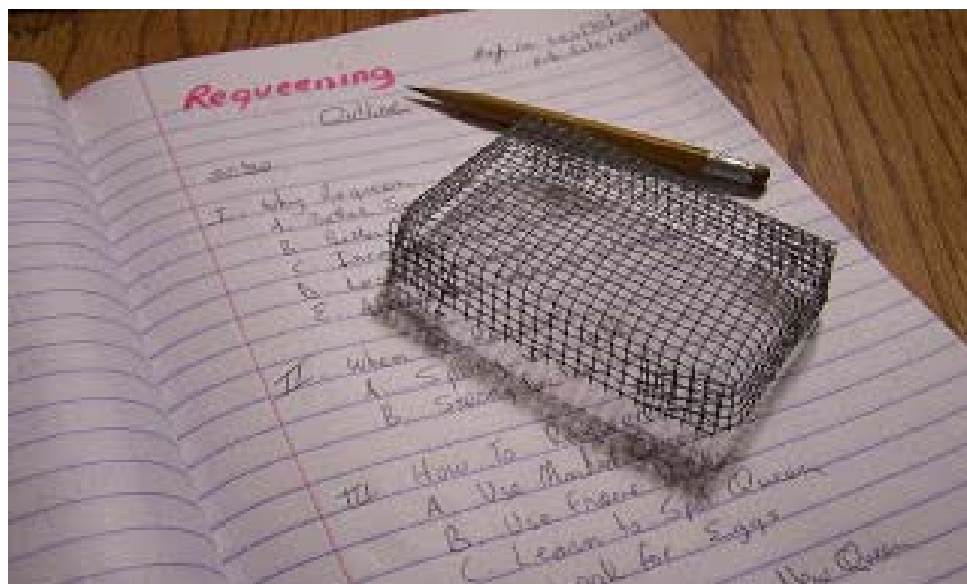
So, after waiting a couple of days, you can now introduce your new queen. Before doing so, check the hive to be sure there are no queen cells. You can remove sealed queen cells and use them in other hives such as splits, nucs or queenless hives by gently pressing them into the comb of a queenless hive.

How Do I Introduce A New Queen?

There are many ways to introduce a queen. It boils down to two basic methods. Direct release and indirect release.

Direct release is rarely a good idea as the bees will usually "ball" the queen and kill her. On rare occasions I have directly released queens into queenless hives successfully. Once I covered the queen with honey, and set her near the entrance. Bees will come out, clean the honey off the queen, and usually she will walk in once she is well groomed. Sometimes I have sprayed down the hive with sugar water with peppermint extract in the water. The smell seems to neutralize the bees from attacking the queen.

On the other hand, the indirect release method allows the bees a chance to get used to the queen before she is free to walk among them. However, prior to her release, she must be in the hive, but kept safely from the bees who may want to initially kill her.



Old time beekeepers used a method that is still very successful even today, though many people have either never heard of it, or don't use it. It's a queen cage made out of hardware cloth, shaped like a square, about 1/2 - 3/4 inch tall with the bottom missing. It is pressed down over sealed comb with the queen inside, holding the queen within the cage. Be sure that no other bees are in the cage, only the queen. This gives time for the queen to be accepted by the other bees.

What has almost replaced this method is that of indirectly releasing the queen in cage she was shipped it, the mailing cage. These shipping cages are the same that are included with packaged bees. However, some queen suppliers are using a combination of a mailing cage and a push it screen cage.

When your queen arrives in her mailing cage, the cage will have a candy plug on one end. You will have to remove the cork to expose the candy plug. Now, take a very small nail or pin, and carefully poke a very small hole through the candy plug. Be careful not to make it too large. And when you poke it through, be careful not to injure the queen on the other side. This hole will encourage the bees to begin to eat their way through the candy. This usually takes a couple of days.

Place the cage between the frames. By placing the candy plug up, the queen can always climb up and out and the opening will never be blocked by her dead attendants. By the time the candy plug has been eaten through, the queen will have become accepted within the hive. It is very important to wait one week before opening your hive after installing the new queen.

In one week, inspect the hive to ensure the queen is out of her cage, alive and if you have drawn comb you can inspect to see if she is laying.

Now, let's go back to the old fashioned cage that is pressed into the comb over capped brood. I like it! It works well. Any emerging bees within the caged area immediately take to their new queen. Her pheromone has a chance to spread over comb and on to other nearby bees. This is a good method to use in September to help the queen become accepted in the absence of a nectar flow.

How Do I Select New Queens and Where Do I Find Good Suppliers

Trial and error will lead you to a good queen provider, and the supplier may or may not be a well-known and long established breeder. You may find that the best queens are raised by the beekeeper down the road who has a few hives and is willing to sell you sealed queen cells. I have pursued the various ads boasting of a great queen only to find didn't live up to how she was advertised. However, there are some suppliers who go to great lengths to raise the best possible quality queens.

Which Race Of Queen Is Better?

There are many races of queens each claiming to have unique characteristics. Here's a few common ones:

Italian, Caucasians, Carniolans, Russian, and Buckfast. It's a matter of choice In the Uk they are trying to get back to the British black queen which I think is a wonderful idea. If it works is another matter as to me the British bee has been mongrelised too much.

Collecting a Swarm.



Collecting honey bee swarms is an excellent way to replace winter losses, strengthen weak colonies, or start new ones. Primary swarms are valuable; they may contain as many as 25,000 bees plus the queen. In comparison, a 3-pound package will number approximately 10,500 bees. Three considerations to keep in mind before attempting to collect a swarm are 1) how long the swarm has been there, 2) where the swarm is located, and 3) its size.

Swarms normally cluster on a tree limb, shrub, fence post, or on the side of a building. When possible, remove the swarm gently, disturbing the cluster as little as possible, and put it directly into a hive or enclosed container (a cardboard box with a tight-fitting lid works well) to transport it to a new hive or location. If the swarm cannot be cut down, either shake or scrape the bees into a lightweight box. When a swarm settles in a very high tree or on any other inaccessible structure, it is best to leave it there. Such swarms may be an after swarm with one or more virgin queen and their successful capture can be very difficult. Sometimes you can knock these high swarms into a bucket at the end of a long pole and then lower it to a collecting box. The success rate, however, is very low.

Once you have successfully captured a swarm, you can introduce the swarm into your own equipment by either shaking or dumping the bees into an open hive with several frames removed).

If you were successful in getting the queen with the rest of the swarm, the bees will adopt the hive. Using drawn combs is better than foundation when introducing swarms to an empty hive, but one or two drawn combs, preferably with pollen, brood, and/or honey (from a disease-free colony), combined with foundation also works.

Instead of waiting for swarms to simply appear, you can try baiting swarms. Pheromone lures (available from beekeeping supply companies) placed in special light-weight bait hives or empty hive bodies (with or without drawn comb) can be used to lure swarms. Place trap boxes in exposed locations 8–15 feet off the ground (with entrance reduced to keep birds and squirrels out) and check weekly during the swarm season (April–June, depending on your location) so you can transfer any swarms into a standard hive in a timely fashion

Taking bees out of trees and building walls.



Honey bee colonies and their combs can be transferred from a tree or wall into a hive. Because of the amount of work involved and the difficulty of obtaining good combs, you should not consider this method a convenient or easy way of obtaining bees unless you have no other alternative. In many situations, the beekeeper is providing a service for home owners and should charge for it.

The best way of removing a colony from a wall is to remove the siding or other exterior coverings to completely expose the colony. Then cut out the combs and brush or vacuum the bees from the interior of the wall. If exposing the colony is impossible, you may try to trap the majority of the bees out of the tree or wall. The first step in trapping bees is to close up all flight holes except one. Place a cone of window screen about 6 inches long, with an opening 1/4 inch to 3/8 inch in diameter at the apex over the open flight hole. Near the flight hole place a weak hive consisting of two or three frames of brood and bees with a queen or queen cell. In principle, the bees from the colony in the wall can leave freely through the screen cone but cannot return to the old nest, so they will enter the new hive prepared for them. It will take about a month for the brood in the old combs to hatch. By this time, most of the bees will be in the new hive. Keep in mind that completely trapping all of the bees or the queen is impossible.

After most activity from the old hive has ceased, remove the screen cone and leave the new hive in position for a week or longer. If no honey flow is in progress, the bees from the strong hive will rob out the old combs in the wall or tree. After the robbing has ceased, seal off the entrance to the old nest so that future swarms cannot establish themselves in the same location.

Remove the hive on the platform in the evening when all the bees are inside. To avoid the possibility of the hive bees returning to their original location, move the hive at least 3 miles away.

Feeding your bees.

After a honey harvest it may be necessary to supply bees with an artificial honey replacement, or a source of artificial nectar to prevent them from starving.

At other times, artificial nectar can be used to encourage the drawing of comb or to aid in the rearing of brood when real nectar may be in minimal supply or even totally unavailable.

My rule is if in doubt feed them as it will never do them any harm at all.

It is suggested that only white cane sugar should be used in these mixtures, do not use raw sugar or brown sugar as they can contain impurities that could harm the bees.

Also be cautious of powdered sugar because it can contain anti-caking elements that could be harmful to your bees.

Some of the following mixtures refer to ingredients by weight, but volume can also be used and is a close-enough approximation - exact measurements are not necessary.

Never feed bees honey unless it is from their own colony. Honey can carry harmful spores, which are perfectly safe for us humans but can be most deadly for bees.

Imported honey, eg that what you buy from the supermarket, can transfer foreign diseases, which then could kill off native or indigenous colonies.

Making and feeding "Sugar Candy"

Take equal amounts in weight of sugar and water and mix the two together. Heat this until it reaches the thickness of fudge (similar to a soft ball). Pour the mix onto a non-stick surface and allow it to harden.

Once hardened and cooled you can feed the candy direct to the bees on top of the brood frames or near the cluster of bees in the brood.

Sugar Syrup

Beekeepers keep bees to harvest the bee's honey. So at certain times of the year good keepers feed their bees to replace their natural supplies.

Sugar syrup is artificial nectar and is fed to the bees to prevent them from starving. Different mixes are required for times of the year depending on the progress of the colony.

You should always leave some honey for the bees, after all it is there's and they have worked extremely hard for it!

Sugar syrup or artificial nectar is used to promote and encourage the drawing of the wax comb and assist in the rearing of brood, especially when there is a shortage of real nectar. The other reason is to let the bees simply store it as food for the winter.

Spring Feed Syrup Mix:

Use this one to one mix for Spring Feeding, this encourages the drawing of the wax comb.

Mix 1 part sugar (by weight) with 1 part water (by weight).

Use hot but not boiling water to dissolve the sugar and stir until the mixture is clear. Allow to cool before feeding it to the bees.

Late Autumn Feed Syrup Mix:

This is a two to one mix for supplementing the loss of the bee's honey after harvesting it. It also helps replenish their stores for the winter to reduce the risk of them starving.

Mix 2 parts sugar (by weight) with 1 part water (by weight).

Use hot but not boiling water to dissolve the sugar, stirring until the mixture is clear. Always allow for the mixture to cool before giving it to the bees.

A mixture to stimulate Brood Rearing:

This mix is a one to two syrup mixture, used to help stimulate brood rearing and nectar flow.

Mix 1 part sugar (by weight) with 2 parts water (by weight).

Use hot but not boiling water to dissolve the sugar stirring until the mixture is clear. Again, always allow for the mixture to cool before giving it to the bees.

Fondant for the winter

Fondant is ideal for winter-feeding the bees, this can be fed directly to the bees. It is also used for blocking the entrance to Queen Cages during Queen Introduction.

4 parts white sugar (by volume) + 4 parts 2:1 syrup mix (by volume) + 3 parts water (by volume).

In this case, boil the water and slowly add the sugar and syrup, stirring until all is dissolved. Keep heating until the temperature reaches 114°C (238°F). Let the mixture cool, without mixing, and when just warm to the touch begin to mix again and allow the mixture to air, it should lighten in colour. Pour into shallow dishes and save for later use.

I recommend storing the fondant in small plastic containers (old takeaway containers work very well) with lids and when ready to feed the bees, remove the lid and place the container upside down directly over the hole in the crown/clearing board. This is providing that the fondant is firm enough and not likely to fall down through the hole. This method reduces the risk of disturbing the bees in any way.

Some beekeepers leave fondant on the crown board all winter, so that if the bees need a feed it is available to them. Others like to check regularly and feed as and when required. It's all personal preference, but whatever your way of feeding just ensure the bees do not starve.

Preventing the Sugar Fermenting

If sugar syrup is left for a while, the syrup can start to ferment and go mouldy. To prevent this you can add small amounts of Thymol and surgical spirit.

Add a teaspoon of Thymol and Surgical Spirit to every gallon of syrup mix, these are such small amounts that they have absolutely no effect on the bees - in fact, it is the healthiest option, and protects the bees from mould and bacteria that could potentially wipe out an entire hive.

Making and Feeding Pollen Substitute.



Honey bees derive their protein, vitamins, minerals and some carbohydrates from pollens. Since no single pollen source provides all their nutritional needs, honey bees must have a number of pollens available to them to remain healthy and to produce the royal jelly required to feed the queen and rear brood. When colony inspections reveal little or no pollen in the combs, or the anticipated weather is going to prohibit pollen foraging for more than a couple days, it is time to feed some pollen substitute. It also would be best to feed sugar syrup at the same time. The substance that most similarly mimics pollens in nutrition, and can be purchased at a reasonable cost, is brewer's yeast. Yeast can be fed to the bees dry, but they use it much better when it is fed as patties with a consistency similar to peanut butter. For beekeepers operating only a few colonies, the yeast is often mixed with fifty percent sucrose syrup. The patties are encased in waxed paper or in plastic bags to try to maintain the moisture. If patties get hard, the bees won't eat them. Beekeepers, who feed their colonies high fructose corn syrup, use that syrup to formulate patties that maintain their moisture well because of the attraction of moisture to fructose.

Other nutrients are sometimes added to pollen substitutes. When about ten percent pollen is added, we call the mixture "pollen supplement." Some beekeepers tend to add casein, lactalbumin or soy flour to their mixtures. Watch out for lactose and over two percent salt (sodium chloride) with the casein and lactalbumin. Try to get "debittered" soy flour that is expeller processed (retains some lipids) and "toasted" (knocks out enzymes that interfere with honey bee digestion). Also check the soy data sheet to determine if the soy is a "high sucrose" variety or contains mostly stachyose. Stachyose is toxic to honey bees. Pollen substitutes will not generate brood production the way that sources of incoming pollens will. However, pollen substitute will prevent a total shut down of brood rearing if the weather turns bad for a long time. Pollen substitute will also produce "fatter" winter bees.

You can also make your own pollen substitute, easy to do, not as good as some of the commercial products but still ok.

Here's how to make some.



Just to clarify a point. Pollen *substitute* patties have NO pollen in them. Pollen *supplement* patties HAVE pollen in them.

1.5 cups (12oz.) granulated sugar

.5 cup (1oz.) Brewer's yeast

1.5 cups (12oz.) Sugar Syrup (2:1) or your honey

NOTE: You can also use regular soy flour. Add water as needed to mix. In warm climates it may be necessary to add an oil to prevent drying.

Mix dry ingredients together. Then add dry mix slowly to syrup/honey until mixture is like stiff bread dough. Press between wax paper. Place bee patty over cluster with wax paper up.

Pollen Patty recipes

To make 24 (1 lb.) patties:

0.5 kg pollen - or more (800 ml or 3.3 cups)

2.5 kg hot water (2.5 l or 10.6 cups)

5.0 kg white sugar (5.3 l or 22.5 cups)

4.0 kg brewer's yeast (6 l or 25.5 cups)

(plus up to 600g or 900ml extra yeast as necessary)

To make 6 (1 lb.) patties:

0.125 kg pollen (200 ml or 0.8 c)

0.625 kg hot water (815 ml or 2.6 c.)

1.25 kg sugar (1.4 l or 5.6 c.)

1.0 kg brewer's yeast (1.5 l or 6.3c.)

(Up to 125g or 225ml more yeast)

Why should you feed?

Many beekeepers can easily tell if their hives have stores of honey. But what is usually missed going into winter and in pre-spring is pollen stores. Without stores of pollen adult bees become weak and there is little to feed the winter brood or available for the spring build up. As an added bonus, bees in pollen or protein rich hives live longer, sometimes as much as 15 days longer. This adds to the overall hive health and the ability to produce and care for more bees both in winter and at spring build up.

How much pollen or patties do you need?

As a rule of thumb, one kilogram of pollen is needed for every one kilogram of bees (9,000 - 10,000 bees). Near the same amount is needed in patties. Once you start supplying patties you must continue until natural pollen is available or the hive will decline and/or collapse.

Where to place your pollen substitute patties.

In mid-February, remove hive cover and smoke the bees down below the top bars. The patty, flattened into a cake about 1.5 cm (1/2 inch) thick, should be placed on the top bars directly over the centre of the cluster. IT MUST BE PLACED WITHIN INCHES OF THE BROOD TO BE EFFECTIVE.

How to use the pollen patty.

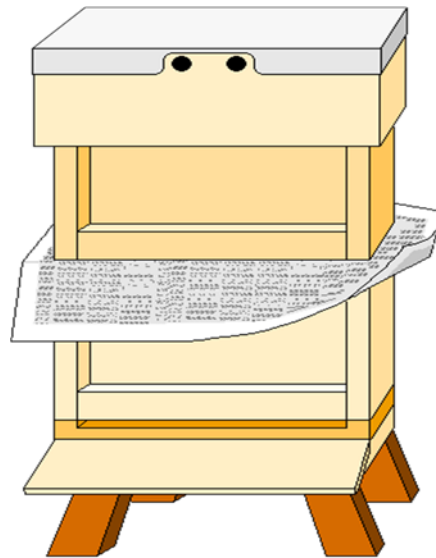
The top of the patty must be covered with waxed paper to prevent dehydration and hardening of the patty. The inner cover, when used, should be inverted with rim side down to provide space for the cake. New patties should be added before the previous cakes are consumed. Feeding patties at seven to ten day intervals is generally satisfactory. Package bees should be fed in the same manner.

Note: When natural pollen is available and the weather is suitable for foraging, the colony will not use the pollen substitute or supplement patties. However, in early spring and during any dearth periods, pollen supplements and substitutes will be readily taken up by the bees.

Other forms of food.

You can also make the supplement food in a thick liquid (like a milk shake) and pour into an in-hive division feeder. This allows more food to be available and with less manipulation. It is ideal for hives in more remote areas.

Re-uniting 2 colonies of bees.



Sometimes you may have to unite 2 colonies of bees. Maybe the queen has died and you are too late in the season to breed a new one. Here is an easy way of doing it, which will not upset the bees and will not lead to them fighting and trying to kill each other.

Newspaper uniter is the most common method of combining two colonies of unrelated bees, that occurs in beekeeping text books.

- One or two sheets of newspaper are placed between the boxes of bees to act as a barrier which will slow down the integration of the two groups of bees. The newspaper is pricked a few times in the area that will be over the centre of the box. This will give the bees a purchase to start the chewing, which will gradually open a passage which bees can pass through.
- This chewing takes time and during it, bees from either side of the membrane have an opportunity to lick each other allowing scents to mingle. Very little fighting normally occurs, although on odd occasions fighting results in the deaths of many bees. Luckily such occasions are so rare that I have only seen it once in a thirty year period and I am one that has taken a few chances.
- Leave the united bees alone for a week, they will have removed most of the newspaper and it will be seen as scattered fragments in front of the hive entrance.
- A queenless or weak colony may be united with another. Put the weaker colony on top of the stronger one. Many texts will tell you to kill the least desirable queen in one of the two groups to be united, but I find it is often prudent to leave both queens, so that the bees can make the choice, in most cases the younger and fitter queen remains, but there may be subtle things in a queen's make up that the bees are better able to make choices about rather than the beekeeper.
- There is a variation to this method... If the lower colony already has a honey super on, this can be left in place and the newspaper positioned on top of the super, rather than the brood box.

Yet another variation is to use one or two queen excluders, so that the bees combine, but the queens cannot meet. If the upper box does not contain frames, a swarm may be dumped into it. In either case the queen from the upper box will be found on the upper surface of the topmost queen excluder after most of the bees have gone through the newspaper.

Oxalic acid treatment of a broodless colony.

- The final treatment of the colonies in autumn or early winter is a component of many anti-Varroa treatment regimes. The aim is to reduce the Varroa infestation level to an absolute minimum, so that in the following season there is no problem with Varroa before the late summer.
- This procedure has proved itself to be effective in beekeeping practice. It is one method of anti Varroa treatment which does not cause residues in the hive products as oxalic acid is an organic substance.
- The treatment is carried out after the colony has ceased to rear brood, around December and January.
- In this brood free condition one treatment is sufficient to achieve an effectiveness of over 90%.
- This treatment can also be carried out in other months, when you have a swarm or when you do the curry method or other method of swarm control. It can be done, once a year only on a brood less hive.
-

Making up and dosage of the Oxalic Acid Treatment.

- **The trickle method at a glance**
 - 1. A 3.5% solution of oxalic acid and sugar. (200 g sugar 35g oxalic acid “accurate measurements please “dissolved in 3/4 litre of warm water, then more warm water added to the solution to make a 1 litre total quantity).
 - 2. 100 millimetre syringe.
 - 3. Acid proof gloves (important!)
 - 4. Each colony is dosed with 30 to 50 ml. of solution at a dosage of 5 to 6 ml. per occupied frame space. (seam)
 - 5. Treatment is in November or December at just above 0°C. Try to administer when there is some weather coming up that will enable them to fly and relieve themselves Administer treatment in as many droplets of solution as possible and drip onto as many bees as possible. (Do not shake solution onto bees!)
 - 6. The fall continues for 4-5 weeks.
 - 7. Good efficiency only in brood free colonies.
 - 8. Two applications is one too many.

The are other ways to apply, but I have left then out as I think they are a little dangerous for a beginner and the trickle method as proved to be the best.

In conclusion.

So that is about it with regards to basic manipulations. There are other things to learn. In fact you will be learning right up to you going to heaven. I think though that, for a beginner you should have enough to keep you going.

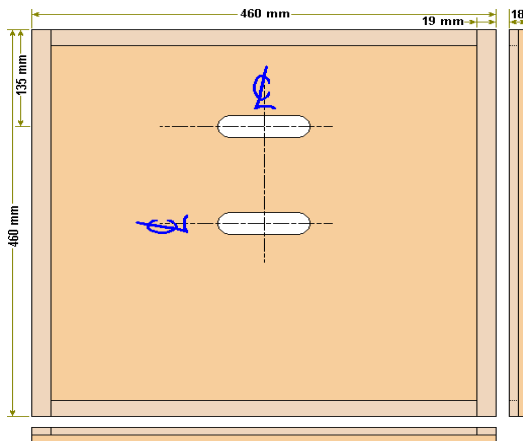
9. Honey Extraction.

We now come to the part where we have all been waiting for. After a year of carefully looking after our bees, it's time to reap the rewards for all our work and patience. Simple but sometimes messy to do but well worth say" I did this, instead of going along to the local supermarket and buying some of the imported stuff they usually sell. There is nothing better than honey from where you live too. Before I start to explain the extraction process I will firstly explain what equipment you will need.

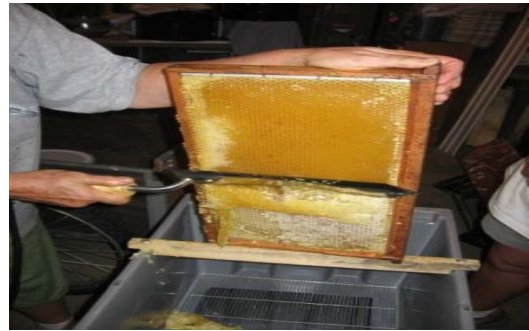
Equipment Needed.

Super Removal.

Firstly you will need to send the bees down into the brood chamber and out of the supers. There are a few ways to do this, but the easiest way is to take off the supers and put on a crown board with a porter bee's escapes fitted. Put the supers back on. Best to do this in the evening so that by morning all you bees will have gone down into the brood box and will not be able to return into the supers, which will now be ready to move to the place where you are going to extract your honey. If you have a few full supers you will need something to carry them as we don't want you hurting your back as the supers can, we hope be very heavy.



When all your supers are into where you are going to extract your honey you will need.

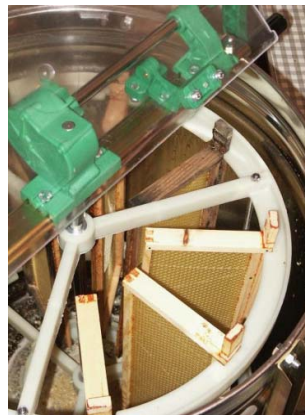


Make sure the place where you are going to extract is bee proof as it's more or less 100% certain that if you don't the bees will find where you are, and in no time you will have a room full of bees.

Equipment used in Honey extraction.



Honey Extractor.



Frames in the extractor.



Straining Tank.



Bottling



The finished product

Honey extraction is the central process in beekeeping of removing honey from honeycomb so that it is isolated in a pure liquid form.

Normally, the honey is stored by the bees on a very regular honeycomb they build on a frame. The frames are typically harvested late summer, when they will be most filled with honey. On a completely filled frame, the cells will be capped by the bees for storage – that is, each cell containing honey will be sealed with a cap made of wax.

Before any honey can be extracted, the honey supers must firstly be removed from the beehive. This is done by.

Sending all the bees down into the brood chamber, so you will have supers that have no bees in at all.

Taking the supers to a bee free place, ready for extraction. Making sure that the room is warm enough so that the honey will be easy to extract from the frames. Some beekeepers use an old fridge with a light bulb inside so that the honey is slowly heated, thus making extraction easier.

I think the best way is to extract your honey as soon as you take it off the hives.

Uncapping of Super frames

- There are a few ways to uncap honey.
- If you have quite a few hives, it may be as well to invest in an uncapping knife. These are obtained from beekeeping suppliers but are costly at around £100.

A better method for the small hobby beekeeper is an ordinary uncapping knife priced at around £12 or an ordinary uncapping fork priced at around £10.

The first step in the extraction process is to break or remove all of the caps. This is done by putting the fork under the wax capping and lifting the capping away. Before uncapping, some beekeepers (especially non-commercial) will remove and store any propolis, by scraping it off. If you want to use an electric knife, it will be quicker but more costly. The wax cappings can be made into honey mead or given back to the bees to remove any honey, leaving you with just the wax.



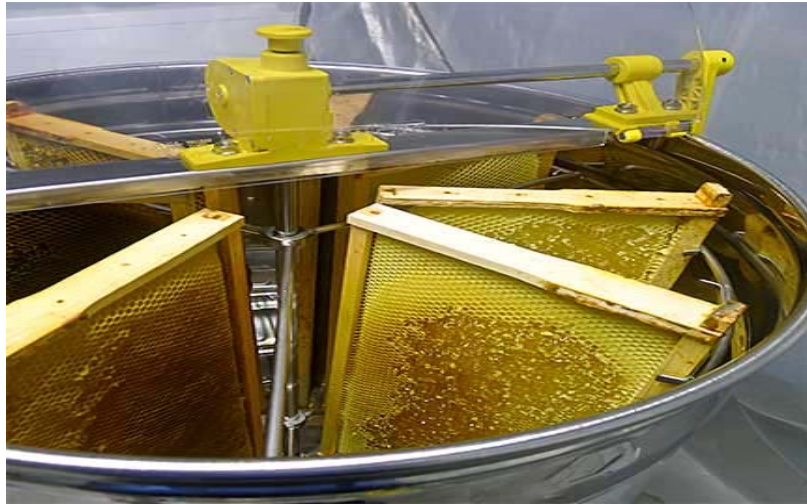
Extracting the Honey

The uncapped frames are then placed in a honey extractor, which spins them so that most of the honey is removed by centrifugal force. Care must be taken to ensure that all frames are the correct way round, as when in the hive the comb is angled slightly upwards to prevent the honey flowing out, this can also prevent the honey flowing out during extraction. The correct way is with lugs out. The resulting honey will contain bits of wax and must be passed through a screen so that clean liquid honey results.

Any honey that can't be harvested, which includes thin films left on the frames after extraction, can be placed outside so that it will be reclaimed by the bees. This must be done early in the morning or late in the evening as the bees will aggressively harvest such a rich source. Care

must be taken so that this is done at a time when food is not scarce, or else bees from differing colonies will fight over the honey.

The extraction process is typically done inside a specialized room, mildly heated for better flow, with all of the necessary tools nearby. The room must be well sealed, as bees (and other insects) will eagerly try to enter and gather the honey.



Honey extractor in us.

Bottling and Finishing your Honey.



- Now that your honey is extracted you will have to.
- Strain and clean your honey.
- Bottle your Honey.
- Label your honey.

Once you have extracted your honey, it will be full of dirt, bee parts and all sorts of rubbish. You will now need to get it clean ready for consumption, selling or showing. There are various ways to do this, mostly depending on how much you have to how much you want to spend on the equipment needed. A proper stainless steel filtering tank can cost you several hundred pounds, whereas a simple sieving system far less. The more you sieve the cleaner it will become. If you are showing your honey it will need to be exceptionally clean as this is what the judge is looking for. I would suggest you sieve at least 3 times for the show, whereas twice will be ok for general use and to sell.

Here are some illustrations of what you can use to sieve your honey.



Bottling and labelling honey is a tedious job, but it can be speeded up a lot. Here are some tips:

I prefer to use only one size of honey jars: 454g glass, squat jars.

1. I wash new jars in the dishwasher, 50 at a time.
2. I do not use reclaimed jars, unless they have been returned with the label removed.
3. A national crown board makes a good tray; it holds 25 jars and they won't slide off.
4. I fill and weigh jars on my own design bottling station, which can be inclined. It took just a morning to make, and I wouldn't be without it.
5. I weigh every jar as I fill it, using an electronic kitchen scale. If you buy one, make sure it has a large long-life battery, not a little flat "coin cell".
6. I fill every jar to between 1lb ¼oz and 1 lb. ½ oz. It's much easier to watch the weight increasing using the imperial scale rather than the metric.
7. I use gold plastic lids, unwashed but wiped. I do not reuse lids.
8. I hold the jar with a tea towel while fitting the lid, to avoid finger marking the jar.
9. I keep a running count of the number of jars of each type of honey.

There are laws in the UK with regards to selling honey which can be strictly enforced by the local councils trading standards office. I would advise, if you intend to sell your honey to obtain the latest information with regards to these regulations.

10. Winter work and making your own equipment.



Now that the main Beekeeping season is over does not mean that you can sit back and think of next season. Things need to be done. Many beekeepers have been caught short in the spring, summer and autumn months because they have failed to carry out essential work and jobs that should have been carried out in the quiet winter months. In this the final part, I will show you some of the work you will need to do to make life a lot easier for you in the following year.

Make sure your hives are secure and protected from any winter rain and storms.

- Once you have finished with the main season and have carried out your final oxalic acid treatment there is little else you can do as far as beekeeping is concerned.
- What you have to make sure is that your hives are protected from the storms.
- Make sure that they are protected from animals.
- That your hives are protected from any damp and rain getting into the hives.
- Always remember no amount of cold will kill a healthy wintering beehive but damp, rain and storms and disturbance will.
-

Check and replace any damaged frames and replace any dirty combs.

During the spring, summer and autumn, some of your frames in the brood box and supers will become damaged and the wax foundations will become dirty and made smaller by build-up of wax etc. These will need to be replaced as dirty combs mean disease and small combs means smaller inferior bees. Any damaged frames can fall apart when they are propolised up when the bees are active so need to be in tip top condition.

Storage of your brood boxes and supers.

- When the season is over, you will need to store all your brood boxes and supers.
- They will need a coat of wood preserver to the outsides.
- They will need proper protection from the damp.
- They will need protection from wax moth. Please refer to the earlier chapters regarding details on storage of equipment.
-

Make sure you have one extra, clean set of equipment for each hive you have.

Nothing worse than when you need extra equipment and you have not got it and need to make it up. Now is the time to do this work, whilst it's quiet. Better than flying about and getting yourself all worked up for nothing.

- So now is the time of year to check to see you have enough.
- Extra brood boxes.
- Hive stands.
- Brood frames with foundation ready to be inserted.
- Crown boards.
- Dummy boards.
- Roofs.
- Complete Nuc Boxes.
- Always remember, that next season you will have to artificially swarm your bees. You could have to collect a swarm. You may need to increase your stocks. Now is the time to get ready for all the above as later may be too late.

Make sure you have enough clean supers ready for the honey flow.

- Never be caught out with not having enough supers, its bad management.
- Make sure that all the supers are in good watertight condition.
- Make sure the supers are filled with clean foundation as it stops disease and if you want, maybe to show your foundation it is fit to do so.

On a nice day check to see if your bees are flying.

- When the weather permits, it's a good idea just to go and do an external inspection of you hive, signs to look for are.
- Bees flying to do a cleansing flight.
- Removal of any dead bees outside the entrance of the hive.

All these inspections call all be done without going into the hive. The best policy is to leave well alone as if you have done your work properly before, and if the season before has been kind to your bees they should be fine. Going into to the bees in winter is a sure way to kill them off and is very bad management.

Check your protective clothing, wash and mend.

Make sure that all your protective clothing is well washed and if there are any holes, make sure they are all mended. Getting rid of the smell of bee stings will stop any bees attacking you. This practice should also be carried out at most times of the year also. Making sure that you are protected by repairs needs no explaining.

Instead of going and buying equipment, start to make some of your own.

- Bee keeping equipment is very expensive.
- Whilst some things cannot be made, such as extractors, many things can.
- So if you are that way inclined, have a go.
- It will give you something to do in the winter months.
- When you have made it you can be proud of what you have achieved.
- With the money you save you will be able to save for the more expensive things that you will need.

Oxalic Acid treatment in winter.

- You can treat your bees in winter to prevent Varroa Mite buildup over the winter months which will give your bees a good start in spring as they will be virtually free of Varroa.
- This treatment can only be done in winter when the temperature around 2c to 5c, this will insure that the queen is not laying and that the hive has no brood. This is because oxalic cannot penetrate into sealed brood, which in that case would make the treatment useless.
- Remember that only 1 treatment is enough and 2 treatments is 1 to many.
- Make sure that you wear gloves and a face mask when preparing the oxalic acid/syrup mixture as raw Oxalic Acid will burn if it comes into contact with your skin, and the fumes are harmful. Again when treating your bees, again wear gloves and a face mask.
- You can also treat the bees in the summer months, but only when.
 1. You pick up a swarm of bees and know they are broodless.
 2. Treat the queen and the flying bee bees which you know will be broodless when you do splitting a hive or the Curry method or any other method of swarm control, where you know that the bees are broodless.

Making up Oxalic Acid Solution.

- 1. A 3.5% solution of oxalic acid and sugar. 200 g sugar 35g oxalic acid “**accurate measurements please**” dissolved in 3/4 litre of warm water, then more warm water added to the solution to make a 1 litre total quantity.
 - 2. 100 millimetre syringe.
 - 3. **Acid proof gloves and face mask (important!)**
- 4. Each colony is dosed with 30 to 50 ml. of solution at a dosage of 5 to 6 ml. per occupied frame space. (seam)
- 5. Treatment is in November or December at just above 0°C. Try to administer when there is some weather coming up that will enable them to fly and relieve

themselves Administer treatment in as many droplets of solution as possible and drip onto as many bees as possible. (Do not shake solution onto bees!)

- 6. Mite fall continues for 4-5 weeks.
- 7. Good efficiency only in brood free colonies.
- 8. Two applications is one too many.

Below are a picture of how to treat with oxalic acid. If you are in any doubt whosoever, contact an experienced beekeepers or a member of your local beekeeping club who will put you on the right track. Never treat, if you are unsure of how to do it.



And Finally.

I hope that this book as help you get started out on this wonderful hobby of beekeeping. Like I said right at the beginning, it is aimed at the very beginner and as such should be treated that way.

As you progress and become more confident you will, I am sure, want to go more into depth, this can be done by maybe getting involved with your local club, where as the old saying goes more heads are better than one..

Join the BBKA if you are in the UK or any association in wherever country you are from Maybe take some of the exams, nothing is compulsory, so if you don't want to bother, do exactly that. As long as you can handle your bees with confidence and care that's all that really matters

The most important thing about beekeeping is enjoying yourself, looking after your bees and knowing that in your way you are playing a small part in the much bigger environmental picture and should make you proud of doing so.

So there we are. Thank you for taking the time to read and best wishes in your beekeeping.

Michael Birt.



I wish to thank the following for their help and patience in the creation of this little book.
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Last night as I was sleeping, I dreamt a marvellous error! That I had a beehive here inside my heart.

And the golden bees were making white combs and sweet honey from my old failures.

Last night as I slept, I dreamt a marvellous error! That it was God I had here inside my heart.

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