

BBKA BASIC ASSESSMENT SYLLABUS

MBBKA 2011 Study Group

Contributors:

Andrew Smith
Anne Mills
Caroline Windley
Clare Hayward-Smith
Jean Mummery
Jill Cochrane
John Armistead
Joe Loxey
Lynda Roche
John Dadswell
Sean Stephenson

1.0 MANIPULATION OF A HONEYBEE COLONY

The Candidate will be aware of:

1.1 the care needed when handling a colony of honeybees;

- Keep in mind safety of self and, particularly, others (consider proximity to public and precautions to be taken)
- Be slow and gentle when manipulating the colony in order to as much as possible keep the bees calm

1.2 the reactions of honeybees to smoke;

- Bees fear for the colony, ingest nectar/honey, and in doing so make themselves full, heavy and less inclined to sting
- Make sure smoke not too hot or too much smoke is applied as the Bees may react badly

1.3 the personal equipment needed to open a colony of honeybees **and the importance of its cleanliness!**;

- Essential – suit, gloves, smoker, hive tool, spare fuel and lighter
- Desirable – bee brush, icing sugar dispenser, container for removed brace comb, container with washing soda for cleaning equipment and cover cloth
- Occasional use – queen cage, queen marking pen and cage
- Must clean equipment between hives and after apiary visit
- Beekeepers are a conduit for the spread of disease

1.4 the reasons for opening a colony;

- To check if “queenright”, sufficient stores and presence of disease
- To check the results of previous manipulations
- To perform new manipulations to achieve specific objectives

1.5 the need for stores.

- During the season a thriving colony requires 10lb honey to survive a week (equivalent of 2 x brood frames of stores)
- Stores primarily means carbohydrate (nectar or honey) also pollen for protein to feed the brood
- To provide the bees with food during the june gap, late autumn, winter and early spring months and during prolonged periods of poor weather in the “honey flow” season

1.6 the importance of record keeping.

- To help manage stocks more effectively by;
 - Reminding you what you found and what you did
 - Enabling you to plan what needs to be done next
- Record information like date, weather, queen sighting, queen cells, brood, stores, space, temper, varroa, supers feed

The Candidate will be able to:

1.7 open a colony of honeybees and keep the colony under control;

- Spend a moment observing bees at the entrance before smoking in order to recognise normal behaviour
- Work from behind entrance if “warm” way and side if “cold” way
- Put roof upturned on floor and supers on roof, with crown board on top to prevent robbing
- Check underside of excluder (or crown board) for queen and return her to the brood
- Demonstrate that you are aware of the use of cover cloths, which prevent more bees from flying up and help maintain the hive temperature
- Demonstrate that you are aware that sometimes using spray of tepid water can be better than smoke, as the former calms them, while the later might panic them
- Return frames in the same order

1.8 demonstrate lighting and the use of the smoker;

- Show you know what fuels are available, which are coolest and that fresh grass in the top prevents hot ash being blown into the hive
- Few puffs at the entrance and wait for it to take effect
- Keep it alight, keep it close at hand
- Occasional use and waiting for it to take effect if the bees become too agitated
- Demonstrate use to control bees and drive them down before replacing parts
- Know how to put it out safely, block top with grass is a good method

1.9 demonstrate the use of the hive tool;

- Keep tool in hand at all times
- It can be used for a variety of purposes: scraper, lever for boxes and frames
- Good practice is to wash it in washing soda between hives

1.10 remove combs from the hive and identify worker, drone and queen cells or cups if present, and to comment on the state of the combs;

- Remove an outermost edge frame or dummy board making space to operate
- Demonstrate responsible temporary storage of removed frames (perhaps in a spare brood box or carefully propped against the hive or even leaning against the queen excluder which might be leaning up to the hive entrance)
- Do not “roll” bees, but use space made to move frames along then slowly lift them out
- Once found, some beekeepers temporarily trap the queen in a matchbox or queen cage to avoid losing or damaging her
- Recognise and comment on brood pattern (colour, age, type etc.), brace comb and spacing

1.11. identify the female castes and the drone;

Females – workers and queen (or telltale signs of Queen)

1.12. identify brood at all stages;

Eggs, larvae, pupae (sealed in cells)

1.13. demonstrate the difference between drone, worker and honey cappings;

- Honey cappings are paler and waxier
- Brood cappings are various biscuit shades and look more fibrous in texture

- Drone cells have a larger surface area and are deeper (longer) too

1.14. identify stored nectar, honey and pollen;

- Nectar is clear and uncapped,
- Honey is capped
- Pollen is uncapped and a range of colours
- All three normally present in an arc round brood cells on the outermost frames

1.15. take a sample of worker bees in a match box or similar container;

- Either shake bees onto an appropriate surface, e.g. Hive roof or position populated brood frame appropriately
- Place the open part of a matchbox over the bees and close it before removing it from the surface

1.16. state the number of worker bees required for an adult disease diagnosis sample;

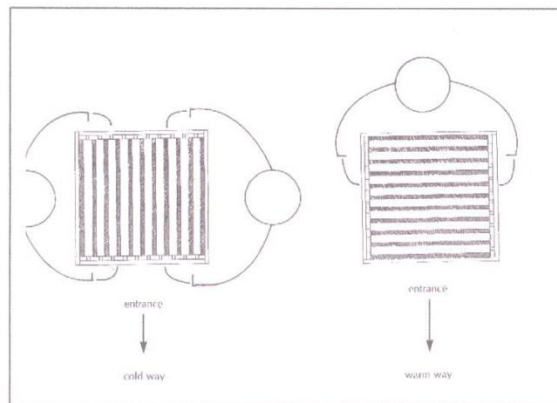
- 30 or so live bees
- 2-300 dead bees for suspected poisoning, most likely found outside the hive

1.17. demonstrate how to shake bees from a comb and how to look for signs of brood disease.

- Make space by removing two frames
- Shake bees sharply from frame whilst it is still low in the brood chamber
 - Hold lugs firmly
 - Jerk firmly downwards, avoid hitting sides as you do so
- May need to do a second/third time to remove all the bees

Tips on the Practical:

1. Ensure you have a clean bee suit and gloves
2. Clean your hive tools and gloves in bucket of washing soda provided
3. Light smoker, use best fuel and take time to ensure it will last for 30 minutes
4. When approaching the hive and before smoking, check entrance for activity, if pollen being brought in comment on it. Also check the orientation of the brood box (warm or cold).
5. Give a few puffs of smoke at the entrance and around the lid. Take your time before opening the hive. Use smoker sparingly.
6. Open hive and place on any supers on up turned roof. Place cover board on top of supers to keep bees quiet and reduce chance of bees from other colonies discovering the honey.
7. When inspecting you should stand either behind or to the side of the hive depending upon whether the brood frames are warm or cold way.

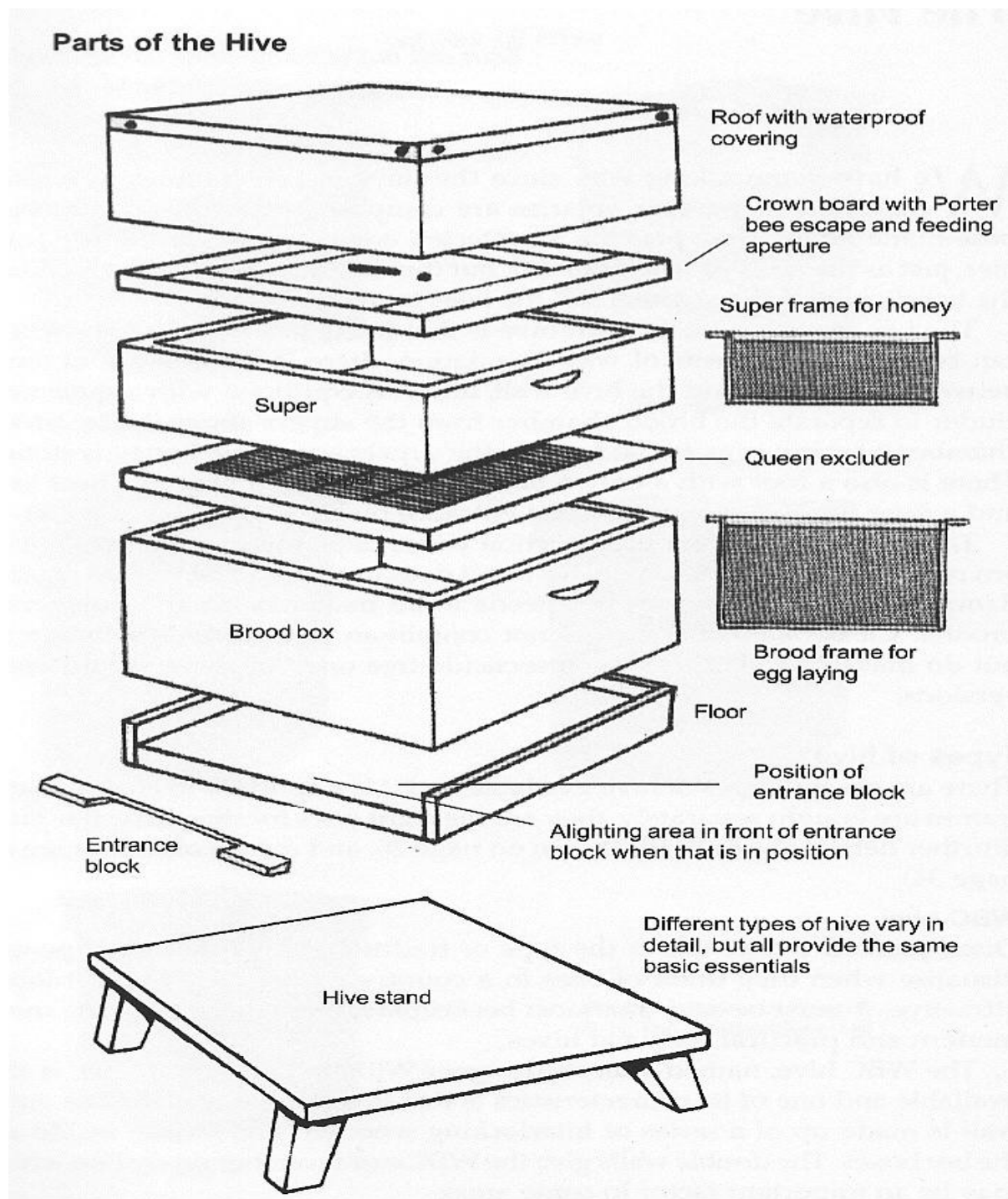


8. Remove queen excluder, check to see if queen on underside, place to the side of the hive close to entrance.
9. Working from the nearest to you, remove the first frame and check if brood present on it. If not, place on the ground in front of the hive or hang it from the stand. If brood present, suggest to the assessor you start from the other end and replace the frame. Talk your way through what you are doing.
10. All the hives in the apiary apart from hive 1 are bottom bee space, you may be asked to state if the hive is top or bottom bee space. Top bee space there is $\frac{1}{4}$ inch gap above the frames, bottom they are flush with the top of the brood/super box.
11. You will be asked to identify eggs, larvae and brood (worker and drone).
12. You will need to identify stores and pollen, stating if you believe there are sufficient stores.
13. Finding the queen is not essential but you will need to find evidence (all stages of brood) and should state that.
14. If asked to show how you would examine a frame for disease:
 - a. Shake bees off a frame (one without the queen on it) by pacing the frame in the space in the brood box and jerk the frame downwards avoiding knocking it on sides or other frames, repeat until all or nearly all bees removed
 - b. Describe what you are looking for
 - c. Explain what you would expect to see if there was healthy brood
15. If asked to take a sample of for disease testing:
 - a. You are looking for older bees, these will be bees furthest from the brood, say the outer frames
 - b. Use a match box
 - c. Open the match box and hold it against the frame
 - d. Gently run the matchbox along the frame and close it
 - e. A sample of 30 bees is required

2.0 EQUIPMENT

The Candidate will be:

2.1 able to name and explain the function of the principal parts of a modern beehive;



2.2 aware of the concept of the bee space and its significance in the modern beehive;

The bee space is simply the crawl space needed by a bee to pass easily between two structures.

If the space between any two surfaces in the hive is too small for a bee to pass through easily, the bees will seal it with propolis. If the space is larger than a bee needs to pass through easily, the bees will construct comb in the area.

This was noted Rev. L L Langstroth in Philadelphia in 1850 by in Philadelphia in 1850. His theory about bee space revolutionised beekeeping. He constructed the first modern hive, using moveable frames to contain the comb within the hive.

He noted the distance between each wax sheet should be constant and uniform and about 7 – 8mm for the western honeybee.

If bees are not happy with a space or gap in the living area they will glue it up. Any space less than 4–5mm will be filled with propolis.

The distance is just enough for the bees to crawl around in and pass each other, back to back, without getting crushed, but not so far apart that they lose the important bodily contact.

Some hives are “top” bee space and some are “bottom” bee space. The National is bottom bee space while the Langstroth is top bee space. This means the space for the bees to crawl through to get around the hive is either below the frame or above the frame.

This created a hive in which the queen could be confined to her own brood box with the other bees allowed freedom of the hive. Honey can therefore be stored in one part of the hive while brood development takes place in another. It became possible to harvest honey without brood mixed in with it and to take comb out of the hive without endangering the colony.

2.3 able to assemble a frame and fit it with wax foundation;

Correct Assembly of Bee Hive Frames

This is a simple task that a beekeeper will repeat many times during his (or her) life. Some may say that it is a chore, but like many things... If the preparation is done right and a methodical approach is made then the work itself passes uneventfully and the stack of new frames is finished easily and quickly.

Prepare a suitable work surface that is sturdy, solid and large enough to stack all the parts on, to do the work and to spread out all the necessary tools. Empty hive boxes are useful to stack the finished frames into.

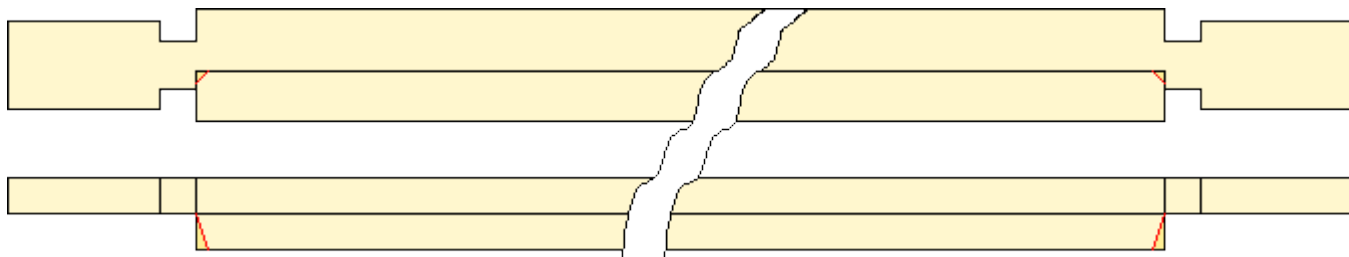
Treat the frame assembly and the fitting of foundation as two separate jobs. Frames can be completed to the first stage in any temperature, but the fitting of the foundation and final assembly should be conducted indoors or in a heated shed.

Before the assembly itself there are some preparations to make...

First lay out all the tools in a pattern that allows them to come to hand easily.

Then unpack all the topbars that you intend to use...

Remove the foundation retaining wedge from the bar with a knife that has a short, blunt blade, but a sharp tip, clean any remaining web from the rebate in the top bar and remove a small tapered chamfer from each end of the underside of the bar as shown in the diagram below.



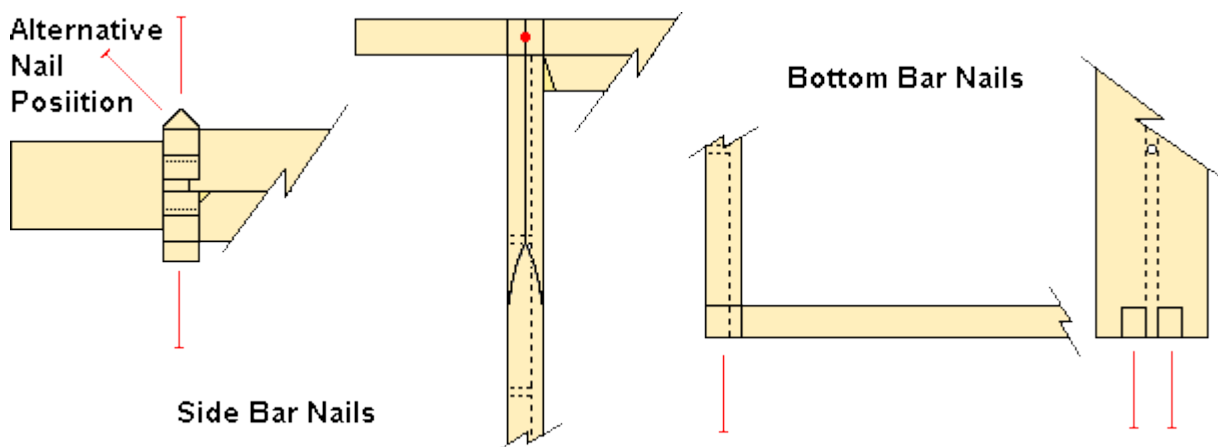
Also remove the sliver of wood that still adheres to the wedge. Repeat this operation until all topbars are processed.

Before we assemble and nail the frame together we must look at what nails to use and how they should be placed.

In my opinion (and the opinion of all major equipment manufacturers) we should use 19 mm Gimp Pins (1 mm Dia Parkerized and stained) for the assembly of the frames, but 16 mm 'deep drive' panel pins should be used for the foundation fixing wedge.

Some find power stapling machines handy for putting frames together. I have done this myself in the past, but I find there is little benefit in speed and the staples are relatively expensive. There is an advantage in grip as staples up to 32 mm in length can be used.

Nail Placement



The mistake most often made is to nail the bottombars through the side of the sidebar (at first sight this seems a good idea as it saves two nails per frame, but it makes the disassembly of the frames very difficult).

By nailing each bottombar individually into the end grain of the sidebar... the nails will pull out easily when you want to put fresh foundation in the frame in 3 or 4 years time.

Another thing that is often done wrong is that a nail is placed vertically downwards into the side bar. This is disastrous as the nail head impedes the scraping action of the hive tool when cleaning burr and brace comb from the top surface of the bar. In addition the nail grip in the end grain is not enough

to handle the weight.

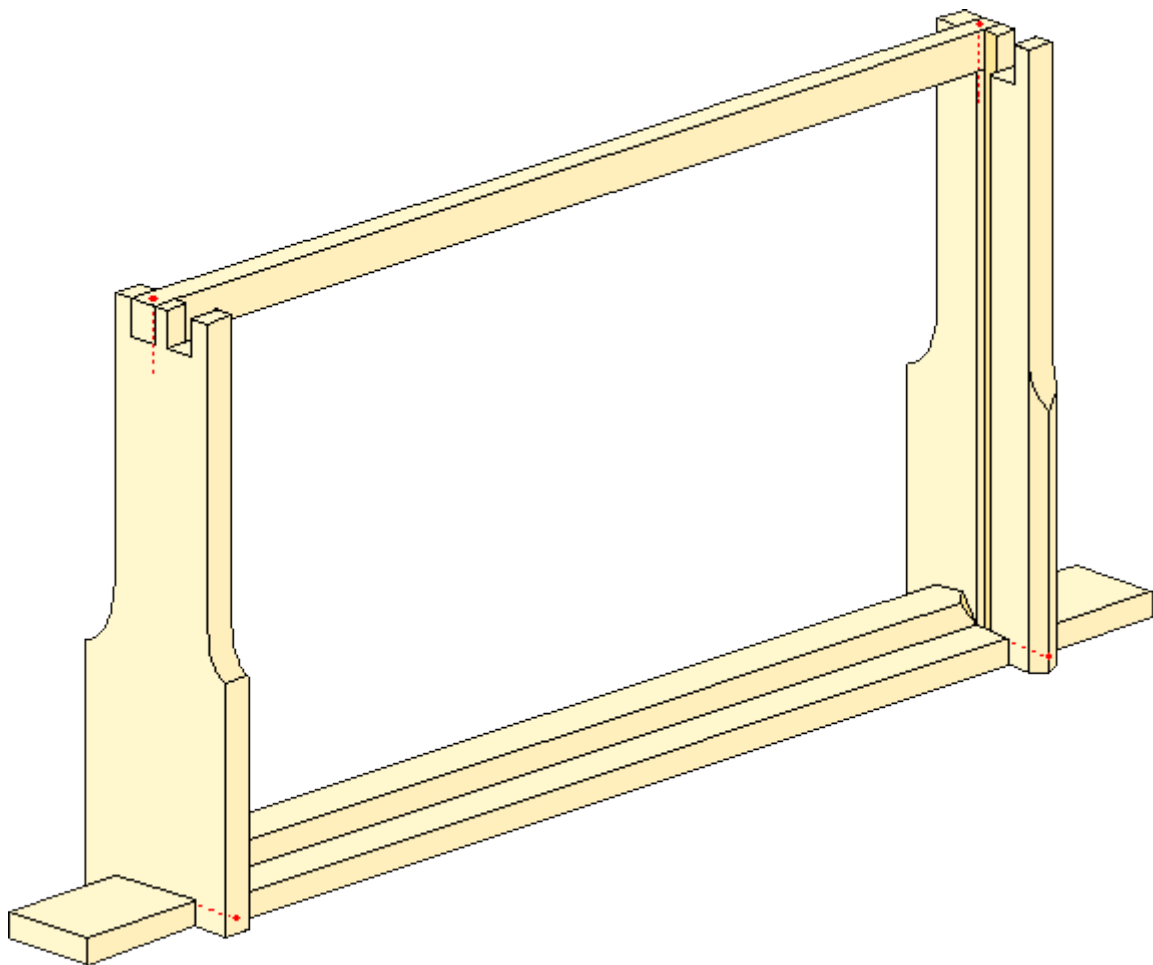
Having sorted out our nails and where to place them we must think how we will put the nails in... There are two methods:-

Warrington pattern hammer (4 Oz Wt) or... Pin Push Tool.

Both have their advocates, but I 'sit on the fence' as I use a hammer for Gimp pins and a pin push for panel pins.

The assembly process...

Take a topbar and two sidebars and push the notches in the sides onto the narrow necks of the topbar, ensuring that the grooves in the sides (if any) face inwards, they will stay in place as they are a tight fit (if they are too tight a little judicious use of a craft knife will adjust the situation). Then with the topbar held in one hand and your lightweight hammer in the other... Place the bottom tips of the sidebars firmly and squarely against the top surface of your bench and lightly tap the topbar at the points where the sidebars sit (this ensures firm seating of the bridle joints). Lay the assembly flat and put in the nails for this side of the frame. Turn over and insert the other 2 nails. Next with the topbar resting on the bench and with the sides pointing upwards add one bottombar (on the same side of the frame as the 'meaty' side of the topbar). The ends of the bottombar must be exactly flush with the outside face of the sidebar. Your partly assembled frame should then look like the drawing below.

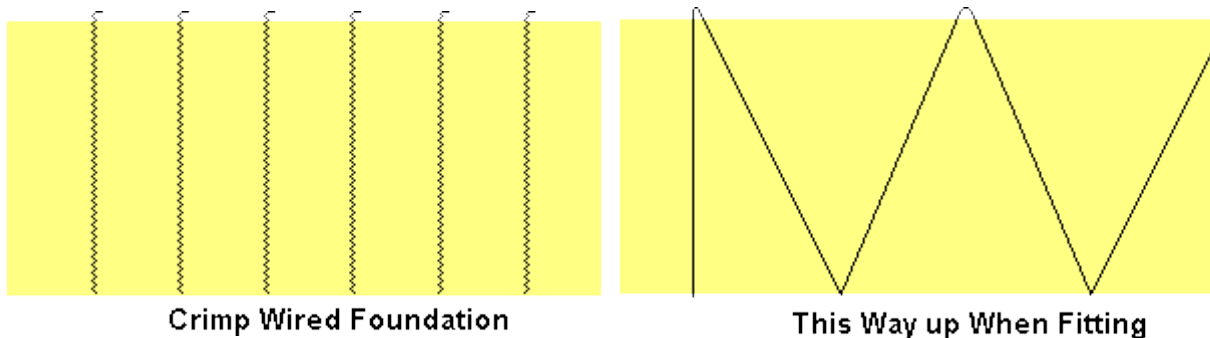


If your side bars do not have foundation grooves, make certain that the 'V's are placed so that they

occur in the positions in the drawing. This ensures that the 'V's always mate with a flat whichever way round the finished frame is placed in a group.

Inspect the part assembled frame for defects (missing nails, groove outside) and check for squareness of assembly. Then stack them in one of the empty boxes and repeat until all frames reach this stage.

The next operation is the fitting of the foundation and the last bottombar, but before we detail this we should look at the methods of wiring in pre-wired foundation as this has a bearing on the placement of the panel pins to fix the wedge bar.



The crimped vertical style of wiring is more common in USA whilst the zigzag method is more commonly used in UK.

The vertical wires extend a few millimetres above the top edge of the foundation and this extension is bent at right angles to form a positive gripping action when the wedge bar is in place.

The zigzag wired foundation needs a little preparation to make it ready to go into the frames... The two small loops that extend from the bottom edge of the foundation must be turned back onto the surface of the foundation so as to ensure that no wire protrudes from the bottom of the frame once it is assembled. (The bees tend to build accretions of wax on any exposed wire and in removing this with your hive tool the wire will be snagged and will rip through the comb rather like a cheese cutter.) The three top loops should be bent at right angles to perform the same gripping function as with the vertical wired type.

Fitting the foundation...

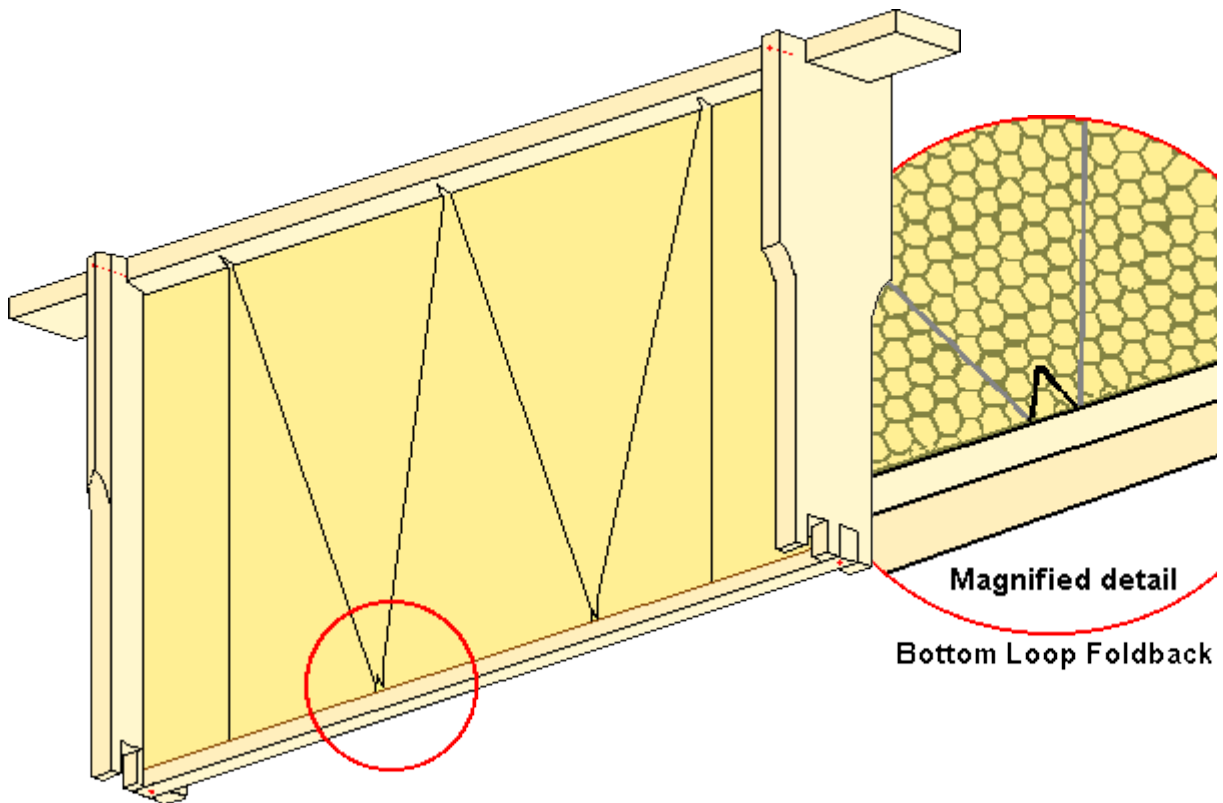
Lay the part finished frame flat on the bench with the single bottom bar downwards...

Slide the foundation into the grooves ensuring that the wire ends or loops are uppermost (The foundation must slide freely in the groove... trim a small strip from one side if required) (use a metal rule and a Pizza Cutter)...

Fit the wedge bar to trap the protruding wires or loops and push the 3 panel pins diagonally through the wedge bar so that the pins also go through the loops or pass between wires for the crimped wire type. The angle of penetration should be such that the points of the nails cannot protrude through the other side of the timber. (This would disrupt normal frame cleaning as the hive tool would be impeded.)

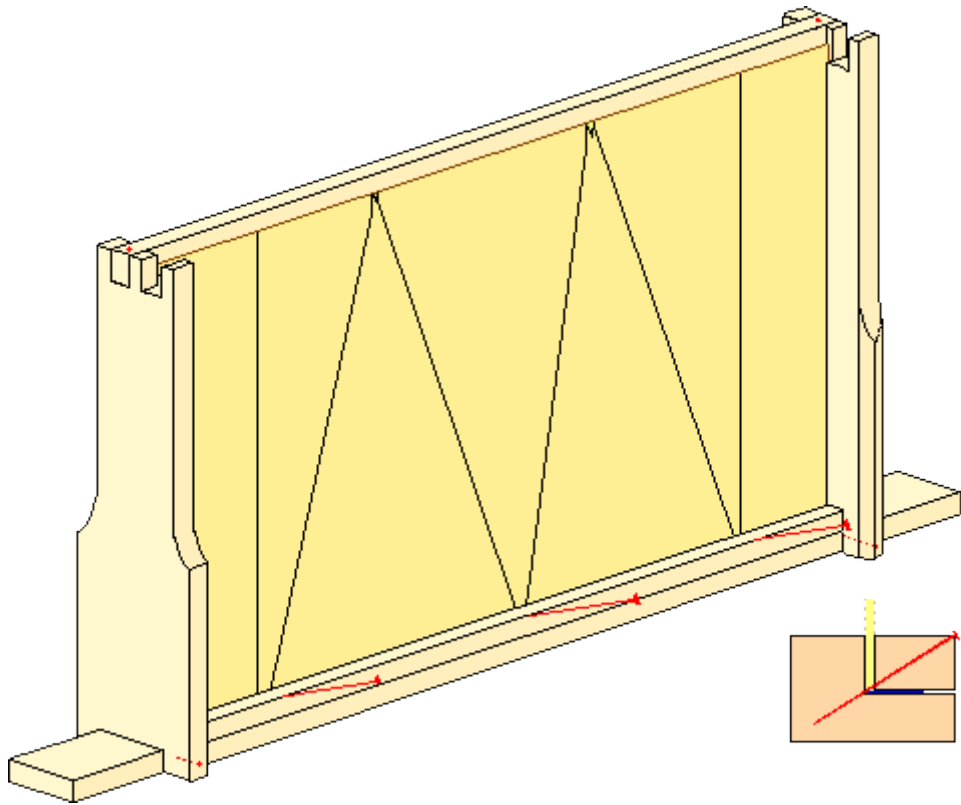
The bottom edge of the foundation should rest about halfway between the top and bottom edges of the bottombar. (This gives room for the foundation to stretch under the weight of bees that will be drawing it.)

Fit and nail the second bottombar being careful not to buckle the bottom edge of the foundation.

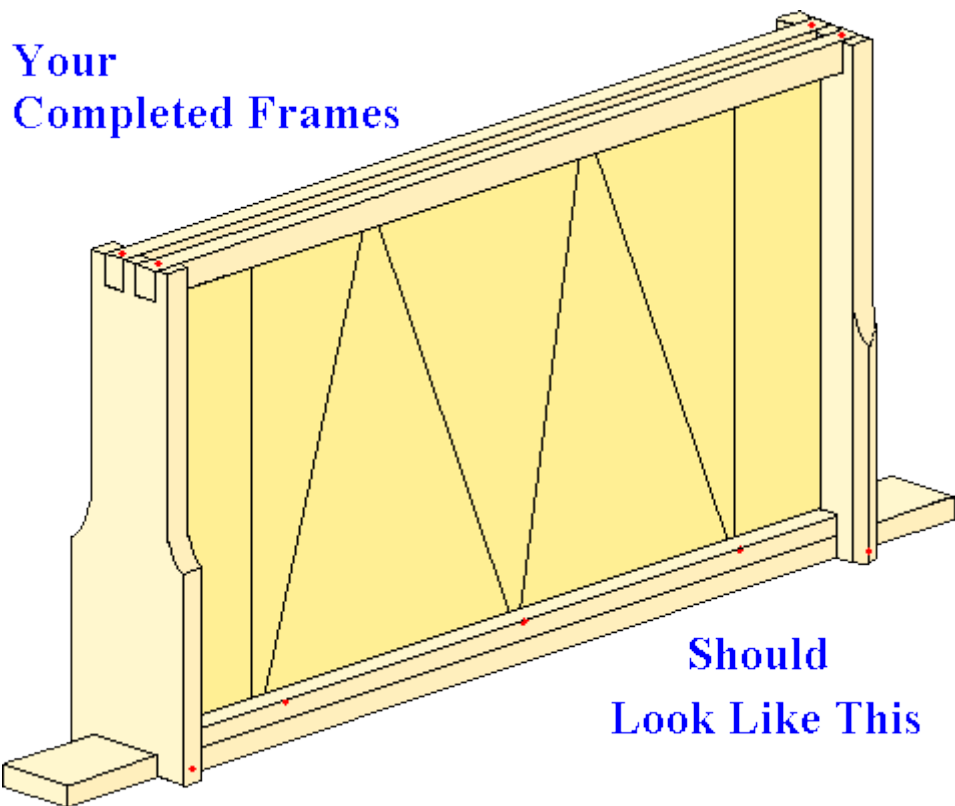


This view shows how the frame should look just before you fit the wedge bar.

The view below shows the fitting and nailing of the wedge bar.



Inset shows cross section at nailing point.



Repeat until all frames have been completed. Once a rhythm and a method of placing the tools, so that they are in easy reach, is established... the 'chore' becomes a pleasure.

2.4 aware of the reasons for the use of wax foundation;

Wax foundation is available for all types of brood and supers frames, regardless of the style of hive. Foundation is a thin sheet of beeswax impressed with the hexagon pattern of the honey comb, it comes either ready wired or unwired.

The advantage of being wired is that it is stable and prevents “drop out”, (the comb falling apart). Unwired foundation is used for “cut comb”. It comes either as worker or drone foundation.

There are a number of advantages for using these wax sheets, some of which are:

- It aids the uniformity in the structure of comb.
- It stimulates the bees to produce and build comb
- It enables the bees to build comb quicker.
- It simplifies the inspection of the comb.
- Harvesting is made easier, speeding up the process by being more regular shape.
- It enables changing old foundation for new quickly.
- This also helps to keep disease at bay.

2.5 aware of the spacing of the combs in the brood chamber and super for both foundation and drawn comb and methods used to achieve this spacing.

Frame spacing -brood chamber

In a wild bee colony, the spacing between brood combs is always very regular at 30-32 mm: this allows two bees working on faces of adjacent combs to pass each other with just their wings brushing while they tend the brood. If brood frames are spaced wider than 37mm there will be problems with thermoregulation and less brood. Frames containing foundation (for drawing) should also be spaced no wider than 37mm (11 frames per box) as wider spacing usually results in irregular drawing of combs.

National hives hold 11 frames in the brood chamber although there may appear to be room for 12. Don't try to squeeze in that extra frame. Once it is drawn and contains honey it will be more difficult to lever it out without damaging it. Any extra space should be taken up by a dummy board which gives space to manoeuvre the frames without causing damage to bees or comb. Always have the correct number of frames in the brood chamber, and have them correctly spaced, or bees will rapidly fill the gaps with their own wild comb. This causes lots of problems as it can be time consuming and messy to remove and queens are often accidentally damaged in the process.

Frame spacing -super

There is much more flexibility when it comes to spacing the frames in the honey supers. However, the foundation has to be drawn out first and this is best done by using the same narrow spacing as in the brood chamber.

In subsequent years, once the frames are drawn out, they can be spaced at anything from 11 frames per box (37mm) to 8 frames per box (51mm). The bees will extend the cell walls and make the combs fatter. This is referred to as 'drawing the combs wide'. The bees will extend the cell walls and make the combs fatter. This is referred to as 'drawing the combs wide'. The end result is that the amount of honey stored in the full super will be about the same whether 8, 9, 10 or 11 frames are used. However because the frames are heavier this can make uncapping at extracting time a much more tiring task.

Methods of frame spacing

There are three different methods of frame spacing in common use:

- Hoffman self-spacing frames, which give 12 frames per box or 11 and a dummy board (National hive)
- End spacers, in three sizes, enabling a variety of frame spacings from 8-11 frames per box.
- Castellations which are available in three versions of 9, 19 and 11 frames per box.

Hoffman self-spacing frames have a fixed spacing of 35mm. When the frames are pushed up tightly together the spacing will be correct for the bees, the foundation will be drawn out evenly and the combs will be easy to remove for inspection. If the frames are not pushed tightly together then there can be a build up of propolis on the contact faces.

End spacers is the most flexible method of frame spacing because a box can be re-configured by a change of end spacers. The wider the frame spacing the more it invites the bees to build brace comb. Using end spacers is less than ideal for brood frames as it is not possible to get narrower than 37mm spacing. They may also fall off at the wrong moment or get stuck solid with propolis. Also it could provide space where hive beetles could hide away.

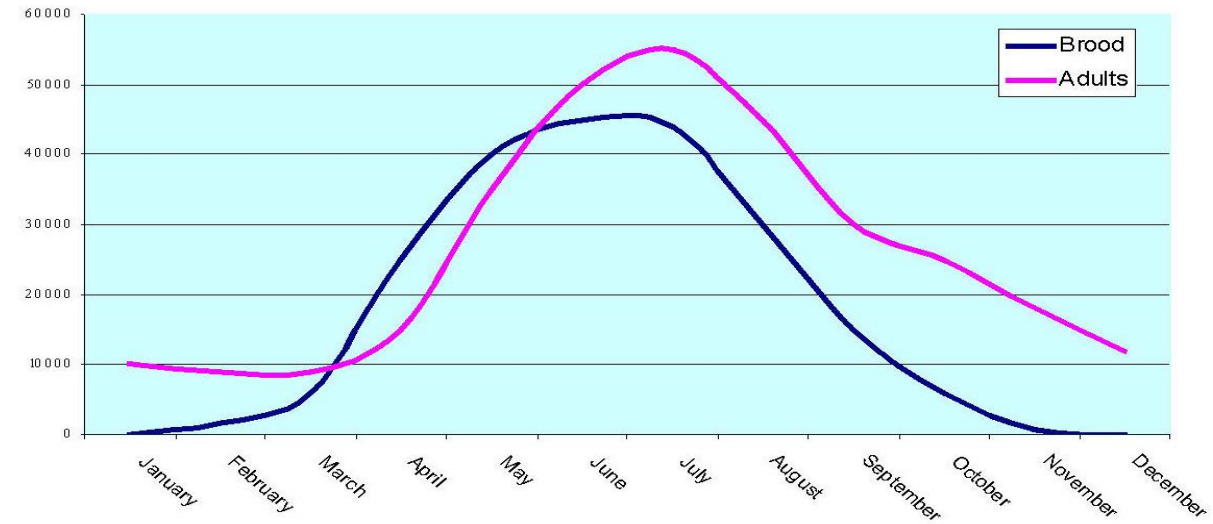
Castellations mean having boxes dedicated to a given frame spacing, so this is not as flexible as end spacers. They are not ideal for brood because frames have to be individually lifted vertically before they can be moved laterally and this tends to roll bees. Castellations are ideal for honey supers because frames are held very firmly and do not rub together and leak honey whilst in transit. This method of frame spacing minimises the build up of propolis.

3.0 NATURAL HISTORY OF THE HONEYBEE

The Candidate will be:

3.1 able to give an elementary account of the development of queens, workers and drones in the honeybee colony ;

The colony population fluctuates throughout the year:



There are 3 castes of bees

- Workers produced from fertilised eggs (32 chromosomes / female but not fully developed / limited reproductive capacity) laid by the queen in worker cells. When the egg hatches into a larva it is fed with brood food, pollen and honey until the cell is sealed on day 8. It moves through the larva/pro-pupa and pupa stage to emerge as an adult bee after a further 13 days on day 21.
- Queens produced from fertilised eggs (32 chromosomes / female with full reproductive capacity) laid in queen cups looking very much like peanut shells. When the egg hatches into a larva (day3) it is fed continuously on royal jelly until the cell is sealed on day 8. The queen emerges after a further 8 days on day 16. Sexually mature and ready to mate 4-5 days after emergence.
- Drones are produced from unfertilised eggs (16 chromosomes / male) laid by the queen in specific drone cells. The cell is sealed after 10 days and the male bee emerges after a further 14 days on day 24. Sexually mature 12-14 days after emergence.

During the spring to summer build up the colony may swarm. To enable this new queens are produced. The old queen leaves with the swarm to find a new nest site.

In the spring drones are produced in smaller numbers reaching a peak of some 400 and are evicted from the colony after the honey flow when their mating function has been completed.

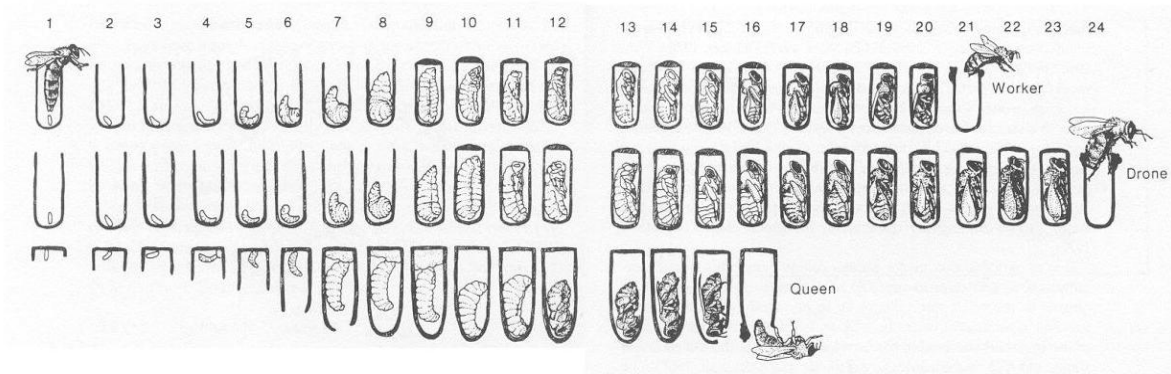
3.2 able to state the periods spent by the female castes and the drone in the four stages of their life (egg, larva, pupa and adult);

	Worker days	Queen days	Drone days
Open Cell			
- Egg	3	3	3
- Larva	6	5	7
- Sub total	8	8	10
Sealed Cell			
- Larva / pro-pupa	3	2	4
- Pupa	9	6	10
- Sub total	12	8	14
Days from egg to bee	21	16	24
Life as adult bee			
- Summer	6 weeks	3 years*	4 months
- Winter	6 months	3 years*	-

*Up to 3 years at the discretion of the beekeeper.

Good rule of thumb on brood proportions during inspections, ratio of worker eggs/larvae/sealed brood 1:2:4, ties days shown above.

Larval Development



Ex: Biology of the Honeybee by Mark Winston

NB: Worker and drones are laid in cells that are approximately horizontal whereas queens are laid and developed in cells that hang downwards

3.3 able to give an elementary description of the function of the queen, worker and drone in the life of the colony;

- Queen (1), only female completely sexually developed, lay eggs
- Drones (300 – 2,000), to fertilize queen “on the wing”
- Workers (30-60,000) to nurse/feed young, draw out comb, build stores, forage for nectar/pollen/propolis/water, live 6 weeks in summer and up to 6 months over winter. In summer in stable colony 21 days as house bees and 21 days as forager.

3.4 able to give a simple description of wax production and comb building by the honeybee;

From about 12 days old honey bees can produce wax in 4 pairs of glands on the underside of their abdomen. Each gland secretes soft wax which is poured into a pocket beneath the gland where it solidifies. The discs of wax are then removed from the pocket and passed to the mouth where it is manipulated by the mandibles to form it into comb.

The combs hang vertically and are double sided. They are made up of hexagonal cells. The cell bases on opposite sides are offset so that the point of contact of three cells on one side is in the centre of the one on the other. Cell sizes can vary to accommodate drone or worker brood.

A gap of 9 mm is the usual space the bees will leave between adjacent areas of capped brood this allows two layers of bees to work back to back. In the part of the comb where honey is stored, the cells are extended so that the space is only sufficient for one layer of bees to work in it easily.

Workers will hang in tight chains forming clusters in order to maintain the temperature at 35°C in order to be able to manipulate the wax. A good nectar flow is required for wax production and comb building, it takes x10 energy to produce wax than honey.

3.5 aware of the importance of pollination to flowering plants and consequently to farmers and growers;

Pollination refers to the transfer of pollen granules from flower to flower that certain plants rely on to reproduce. Some crops such as corn (maize) are wind pollinated, but an estimated third of the food we eat relies directly on pollinating insects. These foods include top fruits, berries and many vegetable crops.

Plant growth and reproduction has several limiting factors such as water and nutrient availability, but pollination also plays a vital role. Pollination can limit the quality, quantity or even entirely deny a crop yield. For instance a poorly pollinated watermelon will not become sweet, and pollination failure in apples will cause blossoms and un-ripened fruits to drop and any fruits reaching maturity would be smaller, misshapen and contain fewer seeds. Some vegetables such as brassicas may produce a crop but without pollination would be unable to produce fertile seeds for the next generation. Pollinating insects are also responsible for cotton yields, and anyone who remembers the nylon era will fully comprehend the desirability of this crop.

Other food production is indirectly affected by insect pollination. Cattle rely on high protein crops such as alfalfa, clover and legumes for about a third of their diet. Wind pollinated crops such as grasses do not contain sufficient protein to sustain healthy productive herds. Therefore our beef and dairy production is greatly influenced.

Although not the only pollinating insect, bees are responsible for pollinating up to 80% of flowering crops. The honey bee is available for pollination duties in great numbers early in the season unlike other insects which do not overwinter in bulk and they are estimated to contribute £165 million to the

UK economy through pollination alone each year (ADAS report for DEFRA 2001). This equates to a generous £600 donation per hive.

Most flowering plants would not survive without pollinating insects and even a decline in numbers would greatly affect crop yields, hitting farmer's profits and consequently market prices.

What makes honey bees good pollinators is that they are systematic and will focus upon a single crop/plant variety and if good quantity and quality recruit more foragers to that nectar source.

3.6 able to name the main local flora from which honeybees gather pollen and nectar;

Buckinghamshire bees have a wide variety of plants from which to gather nectar and pollen, found in a variety of places such as gardens, hedgerows and farms. The following table shows the main plants they use, the months they are available and what they offer to the bees.

Plant	Flowering time	Pollen/Nectar
Snowdrops and crocus	Jan - March	Early pollen source
Hazel	Feb - March	Pollen
Willow	Feb – May	Pollen
Apple/Pear/Plum	March - April	Pollen & Nectar (low sugar)
Hawthorn	April - May	Pollen
Cherry	May	Pollen & Nectar
Oil Seed Rape	April - July	Pollen & Nectar
Sycamore	May	Pollen & Nectar
Dandelion	March - May	Pollen and Nectar
Cotoneaster & Raspberry	June	Nectar
Blackberry	June - August	Pollen and Nectar
Lime	June – July	Nectar
Old Mans Beard (clematis)	July - Sept	Pollen
Rosebay Willow Herb	August	Nectar
Michaelmas Daisy (Aster)	Sept - Oct	Pollen
Ivy	Sept - Oct	Pollen & Nectar

3.7 able to give a simple definition of nectar and a simple description of how it is collected, brought back to the hive and is converted into honey;

Nectar is sugar, water and various other ingredients in very small quantities, collected from flowers and brought back to the hive in the bees honey stomach.

Nectar contains up to 80% water, along with complex sugars. Left in its natural state, nectar would ferment. In order to store the sugars in a usable and efficient state, bees convert the nectar into honey. Honey contains only approximately 18% water.

Older worker bees do the foraging and bring the nectar back to the hive. There, younger hive bees complete the task of turning it into honey.

First, worker bees fly out from the hive in search of nectar-rich flowers. Using its straw-like proboscis, worker bees drink the liquid nectar and store it in their honey stomach. The bee continues to forage, visiting hundreds of flowers, until its honey stomach is about 40% full.

Within the honey stomach, enzymes break down the complex sugars of the nectar into simpler sugars, which are less prone to crystallization. This process is called inversion.

The worker bee heads back to the hive and regurgitates the already modified nectar for a hive bee. The hive bee ingests the sugary offering and further breaks down the sugars. It then regurgitates the inverted nectar into a cell of the honeycomb.

The worker starts to reduce the water content of the nectar by exposing it to the air through rolling a drop on its tongue (proboscis). The nectar is hung in cells and fanned to evaporate further water and reduce it to below 20%. As the water evaporates, the sugars thicken into honey. Once the honey is finished, the hive bee caps the beeswax cell, sealing the honey into the honeycomb for later consumption.

3.8 able to give a simple description of the collection and use of pollen, water and propolis in the honeybee colony;

Pollen

Pollen is the main source of food for the developing brood. It is the source of protein, vitamins and trace elements which is stored around the brood.

Expansion of the colony depends upon the availability of an adequate supply of nectar, but possibly even more so on pollen.

A rapid spring expansion of the hive requires a continuous supply of early spring pollen, without it bees cannot rear brood. So it is a very welcomed sight to the beekeeper to see bees bringing in this colourful ingredient.

Pollen is collected by the pollen foragers. Particles attach themselves to the bee, which it scrapes together into 'pollen baskets' on the back legs. The colour can vary from a bright orange to yellow according to the flower. A by-product of this process is the pollination of crops and fruit trees etc.

Water

Water is needed to dilute honey so that it can be used in the colony, but the cells are not capped until the water content is less than 20%, otherwise it will ferment.

Water is also used to cool the hive in very high temperatures. Tiny droplets are fanned around the hive by the bees.

Water is also used to maintain the humidity within the hive at 40-50%.

70% of initial worker brood food is water.

Propolis

Propolis is a hard resinous substance that bees use to 'glue' the hive together i.e. small holes, joints and gaps etc. Bees also use it to varnish and so strengthen the wax comb. This 'glue' is obtained by the bees from flower buds in the same manner as when the bee collects pollen. It is also believed to have healing properties as it is used in alternative medicines.

Propolis uses in the hive:

- Fills holes and gaps
- Strengthen base of comb where it attaches to hive
- Mummify dead creatures too big to be removed from hive
- Polish cells before queen lays in it, it is antiseptic

3.9 able to give an elementary description of swarming in a honeybee colony;

Swarming is the natural manifestation of a colony having reached the summit of affluence, it is also the bees natural form of reproduction. Overcrowding and congestion in the nest are factors which predispose colonies to swarm.

When a colony prepares to swarm, it has reached a stage in its development where a division of one into two is possible. In a swarm, the old queen and up to half of the colonies inhabitants leave their home together and go in search of new quarters, leaving their old home well provisioned and ready for the emergence of a new virgin queen who at the point of swarming will still be developing in her cell.

This normally happens in late Spring / early Summer and it's possible for hives to swarm several times a year.

Scout bees are the workers who search out the best place to successfully relocate the colony. They take into account various factors such as location, draughts, accessibility and size. Often they have to find a temporary place to stay. This could be in the branches of a tree and within arm's reach if you are lucky!

Signs of swarming include seeing lots of bees clinging to the outside of the hive either hanging from the bottom in a conical fashion or covering the front in a scattered fashion, facing downwards and appearing to be overly active.

Bees normally swarm in the morning. They depart the hive at a great rate of knots and follow the scout bees towards their new home or temporary location. Some of the workers followed by the queen will land and over a 7 or 8 minute period the rest will follow.

During swarming bees will not normally exhibit defensive behaviour as they have neither young or food stores.

3.10 able to give an elementary description of the way in which the honeybee colony passes the winter.

Honey bees over winter as a strong colony clustered together, using their bodies to generate heat, by contracting muscles against each other rather than using their wings.

The cluster is approximately the size of a football, expanding and contracting with the outside temperature, taking it in turn to be on the cold outside.

Honey bees are cold-blooded, they are active throughout the winter eating honey (40lb needed to survive average winter), syrup or fondant to survive. The winter bee is produced at the end of the summer and is fatter than the summer bee, relying on nourishment during the non-foraging months.

A winter bee will live much longer than the summer bee, between 4-6 months rather than 45 days.

The sole purpose of the winter bee is to get the colony through until spring. The population will drop off as summer bees die and are replaced by the smaller winter cluster.

Brood production stops when outside temperature fall below flying temperature, the bees do however take cleansing flights when temperature increases.

If the temperature drops too low the bees will not move and may die of starvation, even if stores are available.

Proper ventilation is vital to keep the colony dry.

Ensure sites are in a safe location over winter, prevent theft.

4.0 BEEKEEPING

The Candidate will be:

4.1 able to give an elementary description of how to set up an apiary;

Home or out apiary

- Home Convenient, all tool etc there no distance to travel
- Can watch the outside of the hive fun and informative
- Might upset neighbours
- Liaise with neighbours before getting bees.
- Might cause spotting on washing
- Out Bees will not disturb anyone
- Usually lots of room
- Have to transport tools often forget something.
- Transporting supers/hives very heavy
- More prone to vandalism and theft

Apiary site

- Check if other apiaries are in the same area – only so much forage – can spread disease
- Check there would be enough forage nearby (at different times of the season)
- Ensure there is water available nearby (this can be provided by you)
- Fence off from livestock – may knock hives over
- Out of public view – reduce risk of vandalism or theft
- Try to make sure there is easy access (by vehicle if out apiary)
- There should be a windbreak to protect from winter winds.
- Check if pesticides/insecticides are to be used regularly nearby – if you keep bees in you may need to provide more shade.
- If near to neighbours ensure there will be time when inspecting the bees will not cause a nuisance
- Ensure there is enough room to inspect the hives (from behind or the side) with out disturbing other hives
- Ensure there is enough room for an extra hive in a suitable position in case of artificial swarms etc.

Cut grass or create a growth free area (weed barrier and bark, paving etc)

Make sure there is no risk of flooding

If not your land make sure you have permission!

Hives

Ensure the hives are not directly under trees (too damp)

Ideal to have early sun and shade from the hottest part of the day

Not in full damp shade

Do not point towards a path or washing

Raised off the ground for ventilation. Can be hives own stand (WBC etc) or separate hive stand.

If second hand make sure you thoroughly clean and disinfect it (and any other equipment)

If more than one hive try and keep entrances away from each other to avoid drifting etc

Don't have the entrance towards prevailing winds

Bees

Get them from a reliable source

If new beekeeper get good natured nucleus – easier to work with

Ensure bees are healthy and strong

Remember 3' or 3 miles rule. If you get a nucleus or colony of bees from someone within 3 miles, you would have to transport them in two moves or the flyers will return to the original apiary

Register with BeeBase (or update details)

OR

Location – ensure bees would be sheltered from prevailing wind especially in the winter. Set up wind breaks if no natural breaks - which also protect from viewing public. Keep location private to prevent theft; don't broadcast where you keep them.

Hives should have some sunshine and shade – protect from intense heat – those who are receive too much of either will under produce. Avoid low lying areas where moisture and cold settles. Locate hive a safe distance away from other animals – horses, cattle, badgers, which may be inquisitive of smell or appears. Knocked over hives – bees may attack and potential kill an animal which could lead to legal action.

Check out with your neighbours - if they are close to your potential apiary site - that they aren't allergic to stings, have young children playing close to area, and have caged animals/dogs chained. Answer questions and listen to concerns they may have, putting them at ease from the beginning.

Public access and right of ways should also be taken into consideration, not a good idea to place too close to passing public. Ideally you want to site 8+ meters away from public access – which should

be a safe distance with a barriers such as a hedge. No hedge /barrier 15+ meters – erect barrier if permitted to do so. Local authorities may not permit hive on there sites, so you much check before you site any hives.

Should the back garden or location chosen not be suitable – look at the countryside, farms, pastureland, wasteland, orchards – gaining permission first. Most farmers would be happy to accommodate, as your bees are helping pollinate there crops. However, do ask farmer to let you know the week before hand if they are going to spray crops near by, so you can protect your bees from potential poisoning, shutting them up or removing them from the site.

Remember you have to carry or push your equipment to site – so access with a vehicle is favourable.

Setting up and arranging your apiary:

Elevate hives – place on hive stand, bricks & treated wood or metal frame.

You could stager hives – arrange in semi-circle, or around trees and bushes – as drifting bees can transfer disease.

If hives in a straight line – you can mark entrance blocks with different patterns which allows bees to indicate the correct hive.

Ensure hives are ventilated – damp hives harbour disease.

Keep site free of debris from hives, cut grass regularly; in general keep neat and tidy.

Bear in mind – sources of nectar, pollen and water, even in the towns/cities there can be abundance, with fruit trees, flowers, vegetable, even weeds. Bear in mind bee's forage in excess of 10 square miles from the location of your hive. Built up areas – remember to place water within close range of hive – so as not to pester/disturb neighbours.

Keep Beekeeping Association Membership up to date – your insurance should things go wrong.

4.2 able to describe what precautions should be taken to avoid the honeybees being a nuisance to neighbours and livestock;

- Liaise with your neighbours.
- Ensure that you have good natured bees. You do not want your neighbours and family to be stung.
- Always site hives where the flight path will not interfere with enjoyment of the countryside or their gardens. (eg not in the flight path of their washing line)
- Consider the direction of the hive entrance, as there will be activity on front of it up to 1m.
- Cover sandpits
- Erect barriers to encourage bees to fly up out of the hive above head height
- Avoid sites bordering roads where pedestrians or riders might pass.
- Try to make sure that the hives are not noticeable by passing walkers or traffic. Hives sometimes get stolen or vandalised.

- Take steps to avoid swarming
- Out apiaries should be fenced from livestock

4.3 able to describe the possible effects of honeybee stings on humans and able to recommend suitable first aid treatment;

Source: BBKA Advisory Leaflet B2 – Bee Stings

Key Points: Take precautions not to expose yourself to being stung in the first place!!

- **Gentle bees**
- **Gentle handling and correct smoking**
- **Sensible times and weather**
- **Clean beesuits with no sting pheromone**

Carry a cell phone and know the post code or grid reference of the apiary.

Immediate response when stung:

- Remain calm.
- Remove the sting asap. Venom is injected within the first 20 seconds. Close the hive gently and move away.
- Smoke the area to mask the alarm pheromone and prevent further stings.
- Close the hive gently and move away.
- Apply a soothing lotion (calamine, witch hazel, "After Bite" etc).

Effects:

- Local reactions – pain, general itching (urticaria), redness, swelling, heat
- General reaction – systemic shock including breathing difficulties, swelling of lips, tongue, or eyelids, vomiting, dizziness, pain.

Treatment –

- Mild reaction:
 - Aspirin or antihistamines with doctor's advice.
- Severe reaction:
 - Call ambulance
 - Seat patient and ensure that they remain calm
 - Loosen clothing
 - Encourage deep breathing
 - Place in recovery position
 - Administer Apipen if carried by patient and use is confirmed by patient

4.4 able to give an elementary description of the annual cycle of work in the apiary;

The timing of operations will vary slightly from year to year depending on the weather and availability of local forage.

Autumn and Winter

This is the start of the bee-keeping year with the colonies being prepared for winter at the beginning of September .

A good sized colony requires around 20 kg of stores to see it through the winter. A full super contains around 14 kg, and there will be some stores in the brood box. If not leaving a full super on the hive,

will need to feed syrup. Syrup should be quite concentrated, 1 kg sugar to 600 ml water, as the bees are less able evaporate the water in cooler weather. If using Fumidil B for Nosema this should be added to the feed now. Reduce the hive entrance to prevent robbing. Heft the hive (straight back) so that you can compare the weight in the new year.

Once feeding is complete the hive blocks should be removed and adequate ventilation checked. This will be much better with mesh floor.

Mouse guards and Woodpecker deterrents need to be on before the first frosts. Bees will continue to fly on warm days, otherwise there is little activity.

Tidy up around hives and ensure they are secure against winter storms. Clean, check and repair equipment.

Review your last years successes and mistakes. Write a list of requirements for the coming year.

Check hives once a month or after especially bad weather to check all is well and the entrances are not blocked.

January

If the weather is mild, heft the hive to ensure it has adequate stores. If it feels light feed with candy or damp sugar on the crown board.

February

Heft the hive to check it has enough stores and feed if necessary.

Towards the end of the month replace solid hive floors with clean ones, and check the debris on the old ones for varroa. If mesh floors are used, the tray should be inserted for the first varroa count.

Ensure you have enough supers, frames, foundation, etc. for the coming year and order new equipment in good time.

Spring and Summer

March

This is a critical month for the colony as the queen increases her rate of lay while the weather may prevent bees bringing in adequate nectar. Heft the hive regularly and feed if necessary.

Ensure area around the hives is tidy, remove mouse-guards and Woodpecker protection.

Check entrances to see that the bees are flying and busy. A little light syrup can be fed towards the end of the month to help stimulate rapid build-up.

April

The colony rapidly expands during this month and the first drones may appear meaning preparation for swarming may begin. Oil Seed Rape can be in flower by the middle of the month so if this is in the area supers will be required before then. This all means that regular, possibly weekly, inspections will be required.

At every inspection you need to answer five questions.

1. Is the queen laying, eggs and larvae present?
2. Are there any occupied queen cells.?
3. Are there enough stores to last until the next inspection?
4. Is there enough space for expansion and storage?
5. Are the bees healthy?

A detailed inspection should be carried out to check the health of the colonies when the weather allows. Warm still day 18 C or above (shirt-sleeve weather).

May, June and July

The summer build up begins in earnest in May as the queen is likely to be at her most productive at

this time and swarm prevention requires weekly inspections. As OSR honey rapidly crystallizes in the combs, this will need extracting towards the end of May, beginning of June.

August

This is when the colonies are most under threat from wasps and robber bees as the nectar flow reduces, so hive entrances should be reduced to help the bees defend their stores.

The honey harvest is taken at this time which intensifies the problem.

A detailed inspection should be carried out to check the health of the colonies

4.5 able to describe the preparation of sugar syrup and how and when to feed bees;

Summary:

- Spring and emergency feed 1kg sugar 1 litre of water
- Autumn feed 2 kg sugar 1 litre of water, winter stores need to be 15 – 20 kg, at least 6 outer brood frames
- Time to feed in spring or autumn if stores low, building up nuc or to a swarm after 48 hours of housing
- Feeding full size hive via rapid feeder or reservoir
- Feed Nuc or swarm via contact feeder to prevent robbing
- Feed at night, and to all hives at the same time

Autumn Feed

A full colony will need between **15kg** and **20kg** of stores to see it through the winter. There will be honey and pollen in the brood box, so it is necessary to estimate the weight of this and consider it when feeding. As a rule of thumb, one fully sealed brood frame will hold about 2kg honey and a full super frame will contain about 1.5kg.

The syrup is made from ordinary granulated sugar from the local supermarket (never use brown sugar or other types of unrefined sugar). A large pan (jam making or similar) is required and into this put **1kg** of sugar for every **600ml** of water. Heat and stir at the same time until all the sugar is dissolved. Do not let it burn whilst heating it. The bees may then not touch it and it might harm them if they did.

The syrup is given to the bees by means of a feeder. This can be a tin or plastic container with holes made in the lid. When full of syrup, it is inverted over the holes in the cover board. A better feeder for use when feeding large quantities of syrup, is the 'Ashforth' type. This is a box the same size as a super and fits on top of the hive. It has a slot in the floor that leads to a passage between two boards into which the syrup can seep and the bees have access. They are thus able to take the syrup without drowning in it.

If treatment for *Nosema* is necessary, then Fumidil B can be added to the feed in accordance with the manufacturer's instructions.

Winter Feed

Candy can be used if the stores are light later in the winter and this can be obtained from the local bakers or made at home. To make it, you will need **2.5kg** of sugar to **500ml** of water and a teaspoonful of Cream of Tartar.

Boil the mixture until the sugar is dissolved and simmer for 10 minutes. The temperature in the pan should reach approximately 120°C and a jam-making thermometer should be used if available. Take

care not to burn the mixture. If you don't have a jam-making thermometer, place a drop of the boiling liquid onto a cold plate. When ready it will solidify immediately to a soft consistency. Allow to cool but before it sets, pour into suitable containers: old margarine or ice-cream tubs will do, or metal trays lined with greaseproof paper. When set, invert and place over the feed hole with the candy exposed to the bees.

Spring Feed

A spring feed may sometimes be necessary. To stimulate the Queen to lay, replenish stores when foundation needs to be drawn out, to cope with the 'June gap'. This should be made of syrup but the sugar content would be less i.e. approx. **1kg** sugar to **1 litre** of water .

4.6 aware of the need to add supers and the timing of the operation;

The need

Honey bees need space for themselves, their brood and the storage and processing of what they bring into the hive. A lot of space is required for food stores as they need enough to see them through the winter when there is little forage and the weather is unsuitable for foraging.

As the brood and increases there is no room in the main brood box for the extra stores being brought in so supers are added to give them this space.

Nectar brought into the hive contains 50 – 80% water and the bees process this into honey which contains only 18% water. The nectar obviously takes up more space than honey and when there is a strong nectar flow space is required to store and process the nectar as well as storing the honey.

Timing

A super should be added when the main brood box has 6 or seven frames of brood and when viewed from above the bees are thickly covering 8 or 9 of the frames. The physical timing of this depends on how prolific the queen is, the weather and forage availability.

As a general rule of thumb, the next super should be added when the last one has 7 out of 10 frames full of liquid.

Adding supers too soon –

More air to keep warm – could chill the brood when weather bad

More woodwork to move when inspecting

Foundation could be chewed & deformed

Stores could be scattered throughout several supers making it awkward for the beekeeper

4.7 one method of swarm control

Think of the colony as if it is made up of 3 parts

- 1.the Queen
 - 2.the brood and it's nurse bees
 3. The flying bees
- Swarm control involves separating one of these 3 parts from the other 2 parts

The Nucleus Method

Have a nucleus box full of frames or a brood box with 4/5 frames ready for when you find queen cells

Put one frame of food plus its bees into the nucleus box
Find the queen and put her and the frame she is on into the nucleus. Remove any queen cells on this frame. This frame should contain a patch of brood the size of a hand.
Put in another comb from the other end of the brood box, this allows the nucleus lots of food
Shake/brush all the bees from two or more frames into the nucleus, fill the box with frames, stuff entrance with grass and cover with the roof
Check the frames in original brood box carefully. Do not remove any queen cells, mark the frames to enable you to find them easily.
Push the frames together and fill the gaps with the other frames you brought with you
Put the nucleus to one side or on another stand. Allow the grass plug to wither or remove after 48 hours.

One week later

Visit on day 8 or 9 before the queen cells hatch
Check through the original colony choose one queen cell
Make sure it is the only queen cell
Leave the colony alone for 2 to 3 weeks, after which time the new queen should be laying.
This colony should not try to swarm again
The nucleus with the old queen can build up or unite with another colony later.

4.8 able to describe how to take a honeybee swarm and how to hive it;

Capturing the swarm:

Equipment needed to capture a swarm:

- Swarm box
- A board slightly larger than the box
- A loose-weave sheet
- A wooden block
- A wastepaper basket
- A scoop
- Soft brushes
- A pair of secateurs, string, a water spray
- A smoker, matches and fuel

The swarm box is usually a cardboard box and an ideal size one is a wine box as this it will fit into a National hive box when trimmed down to 11-12 inches (28-30cm). The box should be liberally painted inside and out with melted beeswax (a hair drier can be used to help the wax soak into the cardboard). Holes 4-4.5mm diameter should be drilled in the sides and bottom of the box to ensure ventilation for the swarm whilst in transit.

Method:

First, if necessary warn neighbours and/or bystanders of possible risks if they do not move away.

Put on your bee suit. Most swarms are not aggressive but not all.

Unless it is late in the day or the weather is cold or wet, spray the swarm gently with clean water. This will hold the swarm in place.

Light the smoker in case it is needed.

Lie the open sheet on the ground near the swarm (preferably in some shade) and place the wooden board plus the block of wood in the middle.

If the swarm is in a shrub or tree you can usually shake or gently brush the swarm into the box. Some pruning with the secateurs may be necessary to gain access or to position the box directly under the swarm. If the swarm has settled in the middle of a hedge, the only option (without ruining the hedge) is to place the box as close as possible above the swarm. It may be necessary to secure the box in place with string. Gentle smoking may be used to drive the bees up into the box. This can be a slow process.

Occasionally a swarm will settle on the ground and then it is just a matter of placing the box over it and letting the bees climb up inside.

When as many bees as possible have been transferred to the box it should be gently inverted on the board. The wooden block is placed under a corner of the box to provide an entrance. The sheet should be folded over the box on three sides leaving the entrance side clear for bees to come and go. The wastepaper basket and/or scoop can be used to capture any stray groups of bees which should then be shaken in front of the box.

You will now need to make sure that the queen is in the box. If she is then the bees in the air and at the original clustering site will gradually move to the box and the bees will start to fan at the entrance. If the queen is not there the bees will move in the opposite direction and the process will have to be started again. It may take up to half an hour to be sure of the outcome.

Ideally the swarm should be left in position until dusk when all the bees have settled in for the night. The wooden board should now be removed and the sheet tied firmly over the opening. The box should be turned with the opening at the top to allow ventilation. It can then be moved to where the swarm is to be hived.

Hiving the swarm:

There are two ways of hiving a swarm – the traditional method and the quick method.

The traditional way is as follows:

A board at least 18 inches (460mm) wide is placed leading up from the ground to the entrance to the hive. The board should be covered with a cloth that hangs down to the ground on either side. This is to prevent the bees wandering off and forming a cluster on the underside of the board. The board

should fit snugly to the entrance to the hive, make sure there is no gap where the queen could get under the floor.

At dusk shake the swarm onto the board somewhere near the top. Their instinct will be to move uphill and they should then locate the entrance and start to walk in. It also helps to raise the brood box slightly to enlarge the gap. Once the bees start to fan at the entrance the rest of the swarm should start to move in the right direction. Once the queen is inside the swarm has been successfully hived.

The quick method of hiving a swarm is to place a floor on the hive stand with an empty box (en eke) on it. Use a shallow box for a small swarm and a deep one for a large swarm.

Shake the swarm into the empty box and quickly (before the bees climb up the sides) place the box of foundation on top, followed by a cover board and roof.

Leave until the next morning and then, using a smoker, drive the bees that are hanging from the bottom bars of the frames up and remove the eke.

Aftercare of the swarm:

The swarm should be hived in a minimum volume hive and kept that way (no supers added) until all the frames of foundation have been drawn. They should be given a generous feed of syrup to help the bees accomplish this task as quickly as possible. A contact feeder containing four litres of medium strength syrup (1kg sugar to 1litre water) would be sufficient.

A large swarm will simultaneously draw all the frames in as little as 48 hours. Smaller swarms will only attempt to draw some of the frames and will leave the rest untouched. When they have drawn an initial set of combs they will start to use them for brood and food storage and will not attempt to draw out any further foundation until they need to – which is when they have fully utilised what they have already got. The rest of the syrup will be stored in the initial set of combs and could later find its way into the honey supers. To avoid this problem the frames should be re-arranged, with at least one drawn frame being moved out on each side of the box and frames of foundation moved in towards the centre adjacent to combs on which the queen has started to lay. This manipulation may have to be repeated until all the frames have been drawn.

When this has been accomplished the syrup should be removed, and then a queen excluder and supers may be added.

During the first three weeks the number of bees in the hive containing the swarm will decline. Numbers will only increase when the first batch of brood starts to emerge.

4.9 able to describe the signs of a queenless colony and how to test if a colony is queenless

Queen cells being produced.

No larve/eggs

An egg stands up in the bottom of a cell. By day three, the egg has laid down on the bottom of a cell and hatched into a larvae. You can see the royal jelly surrounding the larvae.

Even if a mated queen is present but you see no eggs, essentially the colony is queenless.

A queenless hive usually has a louder roar, and usually appears more disorganized. If you do not see any eggs on any frames, then you have a queenless hive.

Signs

- No eggs, larvae or capped brood cells (though of eggs and larvae can mean virgin queen)

- Colony more irritable than usual
- Bees seem less well organised on the frames
- Very few brood cells polished up ready for queen to lay egg
- Pollen in brood nest will be shiny from being covered with honey in order to preserve it
- Possibility of eggs from laying worker
- Stores not being built up

Method of confirming condition

- Remove a frame of eggs and young larvae from another hive
- Shake off bees
- Close up frames and add frame of foundation to outer area of brood box
- Insert frame in middle of queenless brood box
- If after several days workers make queen cells, indicates queenless

4.10 able to describe the signs of laying workers and of a drone laying queen;

Sign/symptom	Drone laying Queen	Laying worker
Similarity		
Brood	Only drones laid and worker cells employed	Only drones laid and worker cells employed
Drones	Small and abnormal	Small and abnormal
Bee Colony	High proportion of drones	High proportion of drones
Difference		
Brood Pattern	pattern even and normal	pattern random
Egg	single egg per cell laid in bottom of cell	multiple eggs in cell some laid on the side of the cell
Queen	Queen present	no queen or queen cell present

4.11 The Candidate will be able to describe a simple method of queen introduction.

Ensure that the colony is actually queenless, has no queen cells and no laying worker. If any of these are present the colony will reject the new queen (and probably kill her)

The colony should be queenless for at least 36 hours. The bees will detect their queenless state and be more prepared to accept a new queen.

Is there a good nectar flow on or do you need to feed the bees? A good supply of food makes for a more positive environment to introduce a queen.

If your queen has arrived through the post she may have attendants and it may be best to release these as you do not want them reacting to the new colony, causing rejection.

Ensure the queen is in (or place her in) a protective introduction cage. There are many different types of cage made from different materials etc, the butlers cage is the most popular in the UK. It is made of wire mesh formed into a box shape, 94mm by 20mm by 12mm, bunged with tin or wood at one end and open at the other. Once the queen has been placed inside the open end should be sealed with candy or with newspaper held in position with an elastic band.

The queen should be placed snugly between two frames of brood where there are plenty of young bees. This can be done by gently pressing the cage into the comb or hanging the cage using a matchstick or something similar between the two combs. The Queen will solicit food from the young house bees and gradually the bees will get used to her scent. The worker bees will slowly eat their way through the candy or paper releasing the queen.

Do not put the queen on the top of the frames (especially in cold weather) as there is a danger she will be ignored.

Leave the colony alone for at least five days, the more they are disturbed the greater the risk they will turn on the new queen. Check that the queen is laying eggs. Leave them alone for the next 10 days and then check for sealed brood. After the next 10 days the bees emerging will be from the new queen and the colony can be treated as a normal colony.

4:12 Aware of the dangers of robbing and how robbing can be avoided.

Definition:

When wasps or honey bees from other colonies try to steal honey from a hive

Dangers

- Weakens the colony
- Spreads disease
- Can lead to fighting

Avoidance

- Reduce entrance size using a block.
- Ensure there is no other entrance (eg through ventilation holes in the roof). Keep hives in good condition.
- Reduce the entrance after removing the supers
- Be aware of hygiene and tidy beekeeping; don't spill sugar syrup or leave wet supers or honey lying around where bees can find them
- Consider apiary lay out to prevent drifting
- Feed in the evening and all hives at once
- Protect the hive during inspections eg by covering frames with a manipulation cloth
- Consider moving a hive in the situation of silent or 'friendly' robbing
- Ted Hooper suggests leaning a piece of glass against the entrance to confuse the robbers. The hive occupants will learn to fly around it
- If bees have succeeded in robbing out a nuc, leave a comb with a small amount of honey on it. The robbers will work on this until it is exhausted and then return home. Removing everything encourages searching and further robbing
- Wasp traps

4.13. The candidate will be able to describe a method of uniting colonies;

Uniting is the name given to the operation where two separate colonies are joined together to make one stronger colony. A weak colony consumes most of the nectar its bees gather to maintain the brood temperature, rarely produces a honey surplus and is much more likely to die out during the winter than a strong colony. By uniting two such weak colonies the beekeeper increases the honey-gathering potential and the chances of survival.

There are other good reasons for uniting and more than one way of doing it, but uniting by the newspaper method is the safest and easiest.

Both colonies are inspected. The queen which is to head the united colony is checked to make sure she is laying well. If worker brood is observed the colony is said to be 'queen-right'. The other colony

is then inspected and the queen is found and removed. A sheet of newspaper is pinned over the top of the brood body of the queen-less colony and the brood body of the queen right colony is taken from its floor and placed on top of the newspaper.

The crown board and roof are replaced on top of this double brood body and the first manipulation is complete.

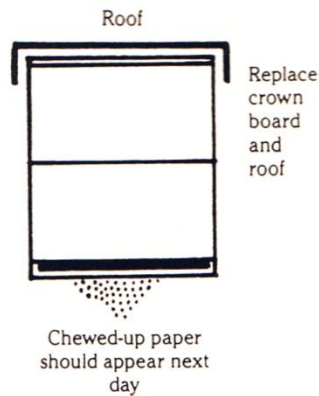
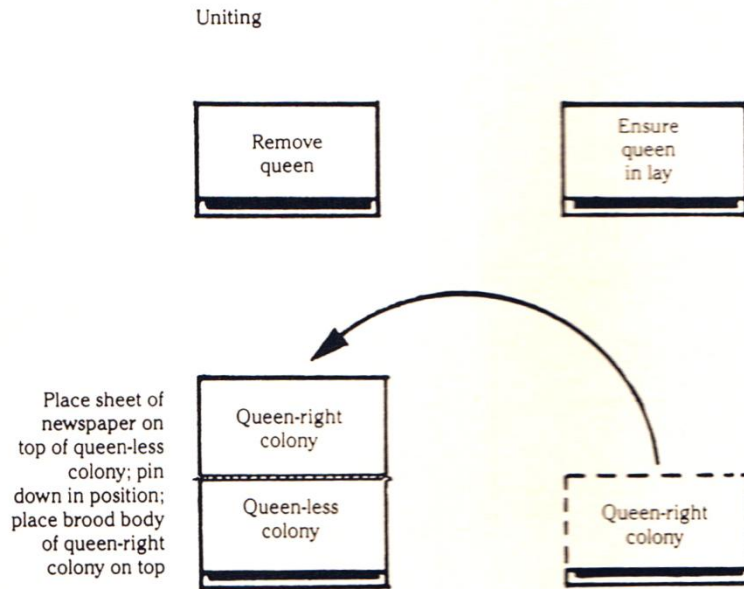
The bees in the top box find themselves imprisoned and start to chew their way through the newspaper. Some beekeepers stab a few small holes in the newspaper to ease the bees' task, but this is not strictly necessary. By the time the two lots of bees have chewed through the newspaper the different smells of the colonies will have intermingled: the queen-less colony will have realised this fact and be keen to rectify their deficiency, and the two colonies should unite without fighting.

After two or three days the hive is opened up and the frames are reorganised. The queen and all the frames containing brood are placed together in the bottom brood body. Frames of food are put on either side of the united brood nest to fill this brood body and the second brood body, and any extra frames are taken away for storage.

Although the queen-right colony should be placed on top of the queen-less colony, this does not appear to be essential as the method seems to work just as well when the queen-less colony is placed on top.

Preliminary actions: check both colonies. Decide which queen is to head the united colony. Ensure she is in lay.

You need: a sheet of newspaper and four drawing pins.



A few days later: open up hive. Place all frames containing brood in bottom brood box, add frames containing food, shake off bees from extra frames into colony and store spare frames in spare hive.

4.14 Aware of the reasons for uniting bees and the precautions to be taken

Why:

- To create strong stock from a weak colony
- To introduce a queenless colony to a queen right colony
- To make a queenless colony queen right

Precautions:

- Remove one queen (choose the least productive queen or one with poorest characteristics or they will fight each other)
- Remove the brace comb or one brood box will not fit snugly on top of the other

- Do in the evening when flying bees are in the hive or this will make the flying bees from the top box homeless
- Separate bees from the different colony with newspaper or the workers will fight
- Leave alone for 7 days until settled

4.15 able to describe a method used to clear honeybees from supers



A very effective and rapid way of clearing bees. The cones are not one way valves but the bees are sufficiently disorientated not to be able to find their way back into the supers. However they should not be left on for more than six hours.



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 crownboard 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 crownboard 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 24 hour period. Requires good weather and a forage flow.



A non-toxic blend of natural oils and herb extracts for clearing bees quickly from supers. Safe to use for both bees, beekeepers and all hive products. Using fume pads or a fume board spray Bee Quick evenly in a zig zag pattern onto the absorbent surface ensuring the liquid reaches the edges.

Remove all hive parts until you reach the honey supers. Place the soaked pads on top of the frames. Supers should be cleared in 2-5 minutes. Repeat as required. Best results will be obtained on a warm day when the vapours will evaporate more quickly.

4.16 able to describe the process of extracting honey from combs and a method of straining and bottling of honey suitable for a small scale beekeeper

Make plans to extract honey so that you can get the equipment ready, then extraction of warm honey will make this process easier.

The first week in September is a traditional time but sometimes honey is taken late Spring too. Choose a suitable hygienic room which is bee proof and cover the floor with newspapers. Wash your hands and have a bowl of water and towel available.

For the whole procedure you will need:

A sense of humour

The honey supers

The extractor and uncapping knife

A bowl to hold the cappings

A board to rest the frames on whilst uncapping

A coarse meshed sieve/strainer to sift out wax particles from the extracted honey

A finer mesh sieve for smaller wax particles

A settling tank or large container

Some jars and lids.

Firstly start by uncapping the combs using a bread knife or special forks/knives for this job, secure the frame on the board over the bowl and with a sawing motion side to side the caps should fall into the bowl. Uncap both sides then transfer the frame to the extractor. A damp clean cloth is very handy throughout to mop up any drips and prevent too much sticky mess occurring!

Extractors are dustbin like containers which come in different sizes, can be manual or electric with a tap at the bottom to run the honey off from time to time. They are radial or tangential, both types use centrifugal force to empty the combs of honey. Load the frames to balance the weight in the extractor or it will move around the room when at speed. Keep an eye on the level of honey and run it off regularly.

It is useful to have help or a little production line as the extractor and buckets can become very heavy plus jars need filling, then wiping and lids applied.

Coarse straining filters out pollen, wax, bee parts etc. stir occasionally to enable a steady flow and prevent clogging.

If you intend to sell the honey it is necessary to remove smaller pieces of wax and debris with a second filtering through a nylon mesh or muslin cloth, the honey needs to be kept warm to allow air bubbles to rise slowly (ripening) over 24 hours.

If using for your own consumption any clean jar or container will do. Clean jars and lids with attractive labels will show the honey to its advantage.

Cleaning up is best done with copious amounts of cold water, and damp cloths for surfaces etc. Super frames can be returned to the hive for cleaning up by the bees or stored wet with honey securely covered in a safe place.

4.17 aware of the need for good hygiene in the handling of honey for human consumption:

Food legislation places a strict liability on anyone who produces any food for human consumption:

Food has to be:

- of the nature, substance and quality expected

- must not be misleadingly described
- must not be injurious to health
- must be fit for human consumption.

All stages of the process from the hive to the honeypot need to be taken into account when ensuring the product is fit for human consumption.

Storing and handling equipment:

Supers and drawn comb should be stored in a clean and dry environment. Honeycomb is a food container just as much as a honey bucket or honey jar, so should be kept where it will not be contaminated by, for instance; mice, oil, paint or fumes that could be absorbed into the wax and leach into the honey. Frames and supers should not be placed directly on the ground or the floor of a vehicle as soil or dirt could be caught in the wax and thereby contaminate the honey. Full supers need to be stored somewhere safe, dry and clean. Keep supers off (potentially dirty) floors.

Cleaning and the extracting room:

All equipment should be thoroughly washed, this will include:

- extractor
- honey buckets and lids
- strainers/sieves
- uncapping tray,
- uncapping forks,
- knives, honey jars and lids

Use hot water and a food safe detergent or detergent sterilant (or sanitiser)

Rinse and allow to air dry or use a dishwasher where possible.

There are very specific requirements for food rooms; these are contained in the EU regulation 852/2004.

Usually the room used for honey extraction will be the domestic kitchen. This room will need to be clean and in good condition. Carpet, laminate or unsealed wood would all be questionable as a suitable floor covering in a food room. If your kitchen has any of these then some temporary cleansable covering should be used.

The kitchen must have a sink with hot and cold water supplies and separately somewhere to wash your hands whilst working.

Work surfaces must be in good condition and easy to clean.

Preparation, hygiene and handling:

- review the equipment to make sure it is in good condition
- clear up and clean the kitchen thoroughly
- ensure there is soap or antibacterial hand washes, nailbrush and towel at the wash basin
- make sure the first aid kit is on hand and has waterproof dressings
- keep windows closed to ensure insects can't get in or use insect-proof screens
- put up a 'No smoking' sign. This is a legal requirement even if no one smokes.

This is a summary of the requirements. A more extensive list may be found at <http://snipurl.com/3pg6e>

You must not extract the honey if you are suffering from any infectious diseases. Cuts, grazes and sores need to be covered with a waterproof dressing that is very visible. Wearing vinyl gloves as well as waterproof dressings is especially useful.

Do not lick your fingers. Don't eat or drink whilst working.

Hand washing is very important before starting, while working and after every time you go to the toilet. Use an antibacterial hand cleanser and use a nailbrush. Disposable paper towels are recommended.

Keep the work area clear, refuse needs to be disposed of and tidy as you go.

4.18 aware of the legal requirements for the labelling and sale of honey;-

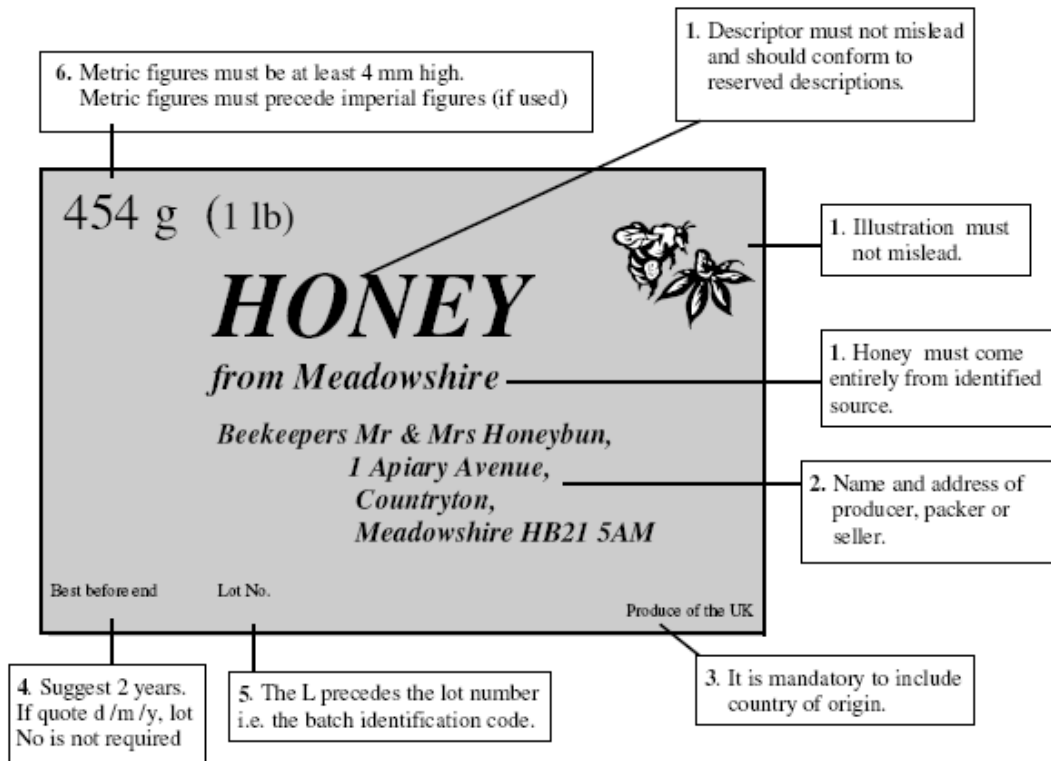
The Honey Regulations came into force on 25.9.03. Labels placed on jars from 1.8.04 will have to comply. In the case of non-compliant labels, it would be necessary to prove the jar was labelled before 1.8.04 and that the label complied with the earlier requirements. The related Guidance document was last revised in Oct. 2007.

The honey label must comply with four sets of Regulations, The Honey (England) Regulations 2003, S.I. 2243 or the corresponding Regulations for Scotland, Wales or Northern Ireland if labelled there, The Food Labelling Regulations 1996, S.I. 1499, The Food (Lot Marking) Regulations 1996, S.I. 1502 and the Weights and Measures requirements. The Regulations around these last are rather complicated and are dealt with below.

The Food Standards Agency have produced guidance notes to help provide informal, non-statutory advice and clarify some of the requirements in the Regulations. Their guidance is general and does not seek to cover every possible issue. This article attempts to answer some additional points that have been raised or come to light but it must be remembered that only a court can decide if there has been an infringement of the Regulations. They are enforced by local authorities. You may be able to obtain written confirmation from your local trading standards or environmental health department that in their opinion your label complies, in which case criticism of it becomes less likely.

The Honey Regulations give rise to two major changes. Firstly, there are differences between these Regulations and those of 1976, for example, the hydroxymethylfurfural (HMF) limit is lowered to 40 mg/kg (except for honey from tropical climates) and 'apparent reducing sugars' has been replaced by (fructose + glucose) with a lower limit of 60% by weight. Secondly, and most importantly from the point of view of labelling, the Regulations make honey subject to all the requirements of the Food Labelling Regulations of 1996; previously it was exempt from Part II.

Sample label



4.19 Able to give an elementary account of the harvesting of beeswax.

Wax was once more highly prized than honey for its use in candles which burned much cleaner and brighter than the alternative tallow, hence the tradition of bee-keeping monks. It has always had other uses such as for polish, ointments, cosmetics, etc.

Pure wax has a melting point of 62 degrees C and can be recovered from the capping's after honey-extraction, which is the best quality, the frames as well as any odd bits of brace -comb. Wax can be extracted using either steam, which is best suited to large quantities as the equipment is expensive, by boiling, or using the sun in a solar extractor.

Solar extractors can be purchased from the equipment suppliers or simply made at home. They are essentially a wooden box with a perspex or glass lid placed at around 45 degrees, with a sloping metal tray inside on which the wax is placed wrapped in muslin, from which the wax trickles in to a collecting vessel, loaf tins are ideal. Old combs will need putting through more than once. After the initial cost of purchase or construction, operation is free, and properly made they will work any month of the year when the sun is shining.



The wax, in its muslin bag, can alternatively be suspended in a large pan of boiling water where the wax will rise to the surface and can be skimmed off in to a mould. In this area rain-water should be used as the hardness in the tap water reacts with the wax degrading it. If using old comb, and the pan is large enough, the frames can be boiled in the same pan to sterilise them once the wax and bag of debris, bits of bee leg and the like, have been removed.

Whichever method is used, the wax is likely to need processing a number of times depending on how contaminated it is. The best quality wax will be retrieved from the capping's, so these should be kept separate from the old combs.

4.20 The candidate will be aware of the need for good apiary hygiene.

Do's and Don'ts

Do's

- a) Keep your equipment i.e. bee suit, hive tool, smoker and wellis clean and free from wax/propolis wherever possible.
- b) Change brood combs regularly, i.e. 2 to 3 per colony per year.
- c) Consider Shook Swarm/Bailey Comb Change at least one colony per year.
- d) Buy bees and queens from a reputable/known source.
- e) Clean up any wax or honey left/spilt in the apiary.
- f) After extracting, if possible, replace supers back on the same hives.
- g) Try to wear disposable gloves, even if you have to put them over others.
- h) Always put supers on an upturned roof and cover with crown board of cloth to reduce robbing.

Don'ts

- a) Feed foreign honey (i.e. supermarket honey) or honey of unknown source or honey from diseased colonies to your bees.
- b) Leave comb/honey in your apiary to be cleaned up/robbed.
- c) Leave `wet` supers around to be robbed, always return to hives late evening.
- d) Buy bees from unknown source i.e. South/Devon, high risk of Foulbrood and or varroa treatment resistance.

TIPS.

Propolis can be removed by soaking equipment in washing soda or wiping with meths. Wash bee suit regularly as stings received at previous inspections will alarm bees to sting without provocation.

Keep an empty bucket with bee tight lid in your apiary to hold comb scrapings/rubbish etc. Keep your apiary clean and tidy; do not allow bees to rob as this can cause disease to spread. Face your colonies in different directions; paint different colours and space well apart to reduce drifting.

If visiting other people's apiaries make sure your kit is clean, particularly when visiting association/communal apiaries.

4.21 Aware of the need for regular brood comb replacement

It is now a generally accepted fact that regular changing of brood frames (and combs) helps to inhibit brood diseases, such as Nosema & EFB. Colonies treated to wholesale frame change out often become the most productive in the colony.

Until recently, frame replacement has been advocated on the basis of one third of the frames every year - ie. a full replacement every three years. However a recent technique, called "Shook Swarm", aims to replace all brood frames in a single operation, thus removing all potentially diseased equipment at a stroke and minimizing disease transfer (a perceived disadvantage of the "Bailey Comb Change", which is the alternative method of complete brood frame replacement).

Timing and Suitability

This technique should only be carried out on strong colonies capable of enduring the stress it undoubtedly creates. It should be carried out as early as possible in the season, but certainly not later than July. Ideally, a good nectar flow should have started, but feeding will undoubtedly be needed to help the bees rapidly draw out the new comb.

5.0 DISEASE, POISONING AND PESTS

The Candidate will be:

5.1 able to describe the appearance of healthy brood;

A healthy colony should build up strongly to fill at least eight frames between April and July, the brood forming an oval shape in the middle of the frame with the queen starting in the centre and working outwards resulting in concentric rings of brood at different stages. Same age eggs/larvae should be together.

There should be single eggs within the cells. Unsealed brood should be curled up at the bottom of the cell in the familiar segmented "C" shape and be pearly white in appearance, yellow and distorted larvae would indicate problems. Sealed brood cappings should be digestive biscuit-coloured and even. Perforated, moist or sunken cappings indicate a problem, as would lots of unsealed cells giving a pepper pot pattern.

5.2 able to describe the signs of the bacterial diseases American Foul Brood (AFB) and European Foul Brood (EFB) and the fungal disease Chalk Brood and describe their effects upon the colony;

American Foul Brood (after cell capped)

Signs

- AFB generally affects only sealed brood
- Larvae die within the sealed cell
- Appearance of the cell capping changes and becomes sunken and perforated as the adult bees nibble holes in them to try to remove the infected larva within
- These perforations tend to be jagged and irregular in shape
- Some cappings may become moist or greasy looking and slightly darker in colour than other cells
- At first only very few cells may show signs of disease and the colony will appear normal in other respects
- Eventually much of the sealed brood will become affected by the disease, causing patchy or "pepper pot" brood pattern
- There may be an unpleasant smell associated with decomposition
- At the sunken capping stage the dead larval remains are light to dark brown in colour and have a slimy consistency
- If a matchstick is inserted and slowly withdrawn the remains can be drawn out in a brown mucus like thread – this is called the "ropiness" test
- The ropy condition is followed by a tacky stage as the larval remains in the cell gradually dry up and the colour changes to dark brown
- The proboscis of the dead pupae may sometimes remain intact, protruding from upwards from the bottom of the cell (sometimes confused with Sacbrood)
- Final stage is a rough scale extending from the mouth of the cell to right back to the base

Effects upon the colony

- Once a colony is infected the disease will usually progress until all of the colony is affected
- The colony becomes unable to replace the aging adult bee population
- The colony becomes weak and finally die out

NOTE: AFB is a notifiable disease under the Bee Diseases and Pest Control Orders for England and Wales

European Foul Brood (before capping)

Signs

- Affects mainly unsealed brood
- Kills larvae before they are sealed in their cells
- Infected larvae move inside the cell instead of remaining in the normal coiled position characteristic of a healthy larva of the same age
- When dead it lies twisted spirally around the walls or across the mouth of the cell or stretched lengthways from mouth to base
- Dead larva collapse as if they have melted and turn brownish – yellow
- Then dry up to form a loosely attached brown scale
- The gut of the infected larva may be visible through the translucent body wall. It will be creamy white caused by a mass of bacteria living within it
- Brood pattern will appear patchy
- An unpleasant odour may accompany severe infection

Effects upon the colony

- The brood will be affected and colony will be weakened and ultimately killed

NOTE: EFB is a notifiable disease under the Bee Diseases and Pest Control Orders for England and Wales

Chalk Brood

Signs

- Only affects sealed brood
- A very common brood disease caused by a fungus
- Fungus invades the body tissues of infected larvae killing them after they have been capped over in their cells
- Perforated cappings
- Adult bees tear down the brood cell cappings to remove dead larvae
- They appear as hard chalky white or mottled grey remains “mummies”
- These “mummies” lie along the length of the cell
- As they dry out they shrink in size so the bees are able to remove them from the comb
- Often noticeable in the hive entrance or on hive floor

Effects upon the colony

- Rarely a serious disease
- Effect on most colonies is slight
- May become serious in colonies that are finding it difficult to care adequately for their brood
- Prevalent in weak colonies during early spring
- No treatment available on the market
- In severe cases re-queening from a chalk brood free colony is recommended

5.3 Able to describe methods for detecting and monitoring the presence of the varroa mite and describe its effect on the colony of the effect of associated viruses.

References: “Managing Varroa” – fera booklet. MBBKA training notes Chapter 10.

Varroa destructor: an external parasite of honey bees. Varroa mites feed on adult bees and brood, weakening them and accelerating the spread of harmful pathogens such as bee viruses. Infested colonies eventually die out unless control measures are applied. Reproductive cycle of three weeks. Bee inspectors recommend that number of mites in a colony should be less than 1,000.

Detection: Mature female varroa mites are recognised by their flat, reddish brown oval bodies (1.6 x 1.1mm). Immature females and male mites exist only in brood cells, are smaller and pale coloured. Other evidence is dead and neglected brood, bees with deformed wings.

Monitoring should take place in early spring, after the spring honey flow, at the honey harvest and late autumn. If significant invasion takes place then monitoring should increase to assess the success of countermeasures.

- **Counting the mite drop using an open mesh floor:** A tray placed under the floor captures hive debris over a period of 5 – 7 days. Includes bees that have died and those which have been groomed off by adult bees. Scrape the debris into a jar containing methylated spirits – the dead mites will float. Calculate the drop rate per day.

	Average Natural Mite Mortality per Day		
Jan. to March	Less than 2 <i>No Action</i>	Between 2 and 7 <i>Plan Control for coming Season</i>	Over 7 <i>Consider Control</i>
April to June	Less than 1 <i>No Action</i>	Between 2 and 7 <i>Light Control</i>	Over 7 <i>Severe Risk</i>
July and August	Less than 2 <i>No Action</i>	Between 2 and 8 <i>Light Control</i>	Over 8 <i>Severe Risk</i>
September to December	Less than 6 <i>No Action</i>	Between 6 and 8 <i>Light Control</i>	Over 8 <i>Severe Risk</i>

- **Drone brood uncapping:** Slide the prongs of an uncapping fork under some sealed drone brood and lift out the larvae. Count the number of mites together with the number of larvae uncapped. This is made easier by including one super frame in the brood box. The bees will extend this frame by building drone comb which can be readily uncapped.

Table 2.

	<i>Proportion of Infested Drone Pupae</i>		
Up to June	Less than 2% <i>No Action</i>	Between 2% & 4% <i>Plan Control for the Coming Season</i>	Over 4% <i>Consider Control</i>
June and July	Less than 3% <i>No Action</i>	Between 3% & 7% <i>Light Control</i>	Over 7% <i>Severe Risk</i>
August	Less than 5% <i>No Action</i>	Between 5% & 10% <i>Light Control</i>	Over 10% <i>Severe Risk</i>

The table shows the level of risk at different times of the year based on the percentage of drones infested by mites.

Dependant on these results, actions will be identified to reduce the levels of mites back to the “No Action” levels in the table.

The effect of Varroa on the colony will depend on the level of infestation:

- This will be barely noticeable in a large and otherwise healthy colony.
- At higher levels the life cycle of the colony will slow and if not addressed, the processes of the colony such as brood rearing, food gathering and colony defence will deteriorate leading to the collapse of the colony.

Additional symptoms:

- Slow build up
- Deformed wing virus

5.4 aware of acarine (a mite) and nosema (**a fungus**) and their effect upon the colony;

Acarine (a mite)

[*Acarapis woodi*](#) is a small parasitic mite that infests the airways of the honey bee.

Life Cycle:

The complex system which delivers oxygen to the honeybee is comprised of tubes called trachea and air sacs. It is in these trachea that the acarine mites reproduce and feed. Mature female mites enter the anterior thoracic spiracles of young bees (bees are only susceptible to infestation within the first nine days after emergence). The mites lay their eggs in the trachea and upon hatching the larvae begin to feed on the haemolymph (blood) of the bee. The trachea are subsequently damaged and become brown and brittle. The larvae undergo several moults before reaching their adult forms, and are then ready to infest new hosts. 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.

Acarine is more prevalent when the bees are confined to the hive or there is overcrowding. When there is plenty of nectar and a lot of flying there is a reduction in the number of infested bees.

The effect on the colony will depend on the percentage of bees carrying the mite, particularly during the winter period, and high infestation may cause the death of the colony. However in the UK infestation levels are low (probably less than 5%) and it is not thought to be a serious problem.

Signs

There are no reliable external clinical signs for the diagnosis of acariosis as the signs of affliction are not specific and the bees behave in much the same way as bees that are affected by various diseases. They crawl around on the ground in front of the hive and climb blades of grass, unable to fly. Dysentery and/or signs of deformed wings may be present. Ararine can be seen using a x30 magnifier after dissection of thorax.

Nosema (a fungus)

Two *Nosema* species have been identified in honey bees in England and Wales, *Nosema apis* and more recently the Asian species *Nosema ceranae*. Both are highly specialised parasitic Microsporidian fungal pathogens which invade the digestive cells lining the mid-gut of the bee, there they multiply rapidly and within a few days the cells are packed with spores, the resting stage of the parasite. When the host cell ruptures, it sheds the spores into the gut where they accumulate in masses, to be later excreted by the bees. If spores from the excreta are picked up and swallowed by another bee, they can germinate and once more become active, starting another round of infection and multiplication.

Nosema apis reduces the lifespan of infected bees, increases winter mortality and causes poor spring build-up. There are no specific symptoms but the disease is linked with dysentery (visible on brood comb and around the hive entrance), disjointed wings and crawling bees outside the hive. Colonies that survive through to summer recover as the bees defaecate outside the hive and infected bees die without transmitting their infection. Spores of *Nosema apis* can withstand temperature extremes and dehydration. The spores persist on contaminated comb and may trigger a more severe infection the following winter.

Nosema ceranae has crossed the species barrier from its Asiatic host, *Apis cerana*, and does not display the symptoms associated with *N. apis*. *N. ceranae* has been found to be more virulent than *N. apis* although numbers of spores build up more slowly. Infected foraging bees die away from the hive and this continuous loss of bees reduces food brought in to the hive until the colony collapses. *N. ceranae* can also be spread when foragers add nectar from their infected crops to the pollen they collect. Feeding larvae with contaminated pollen prevents the removal of infection during the summer.

The effect on the bee is to weaken it and shorten its life by 50%. The effect on the colony will depend on the percentage of bees infected. Quite heavy infestation is needed before the colony is adversely affected.

Signs

Positive diagnosis requires a high-powered (x400) microscope but *Nosema* may be suspected if the colony is lethargic and slow to develop.

Bees with *Nosema* also suffer from diarrhoea. A telltale sign is brown streaks on the outside of the hive. Soiling sometimes occurs inside the hive, particularly early in the year when the weather is cold

and the bees cannot fly out. Any soiled frames should be replaced as quickly as possible because these harbour the spores.

The disease is most severe in the winter and early spring, when the bees may not be able to leave the hive to eliminate waste. It is less severe in the summer when the bees can fly out to defecate and thus remove the spores from the hive.

5.5 able to describe ways of controlling varroa using integrated pest management techniques;

IPM can be applied to control various bee diseases, specifically Varroa.

Implementing controls at various points in the year make it less likely for mites to get out of control

Use of management methods can reduce the need for varrocidides

Using two or more varroacides can delay mites developing residence.

Control strategies can be easily altered to reflect changing infestation levels

No single IPM Varroa Program exists

Using methods below can limit and control:-

Figure 51: Examples of integrated control methods used throughout the year by UK and EU beekeepers (See Table 4 for information about authorisation for use of varroacides in Member States)

Control	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Open mesh floor												
Drone brood removal												
Queen comb trapping												
Formic acid												
Apiguard/Apilife VAR/Thymovar												
Apistan/Bayvarol/Apivar												
Lactic/Oxalic Acid												

Icing sugar??

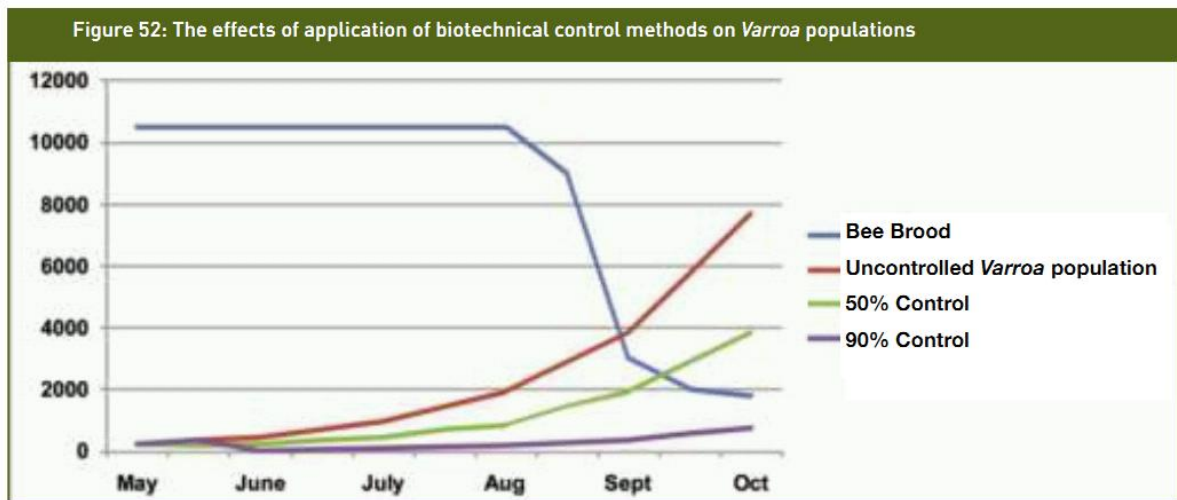
Good Husbandry

This is the starting point for IPM control of Varroa. Keeping a close eye on the health of your bees, recognise signs of Varroa infestation. Aparies should be maintained to minimise robbing and drifting. Keep strong vigorous colonies, try to select strains that seem to show some Varroa tolerance.

Slow mite population growth

Methods to slow the Varroa population – drone brood removal (Table 5 & Figure 54) and use of mesh floors – efficacy of 50%. These methods have less effect than other controls, but delay infestation reaching damaging levels, treating later. Comb trapping and artificial swarm techniques 90% efficacy

(figure 52). Reducing use of chemical control, essential where late crops are sought (heather & Himalayan balsam).



Using Monitoring to indicate level of controls to use (Figure 53 illustrates principles)

Low mite levels – no action required

Intermediate level – Moderate intervention

High Level – Urgent, effective action required

Aim to maintain a level of less than 1000 mites during the beekeeping season.

Levels may change from earlier in the season, which need addressing at the end of season.

Light control – use biotechnical methods or varroacides – low efficacy , limited effect on mite population.

Effective control – use varroacides and biotechnical methods – very effective and greatly reduce mite population.

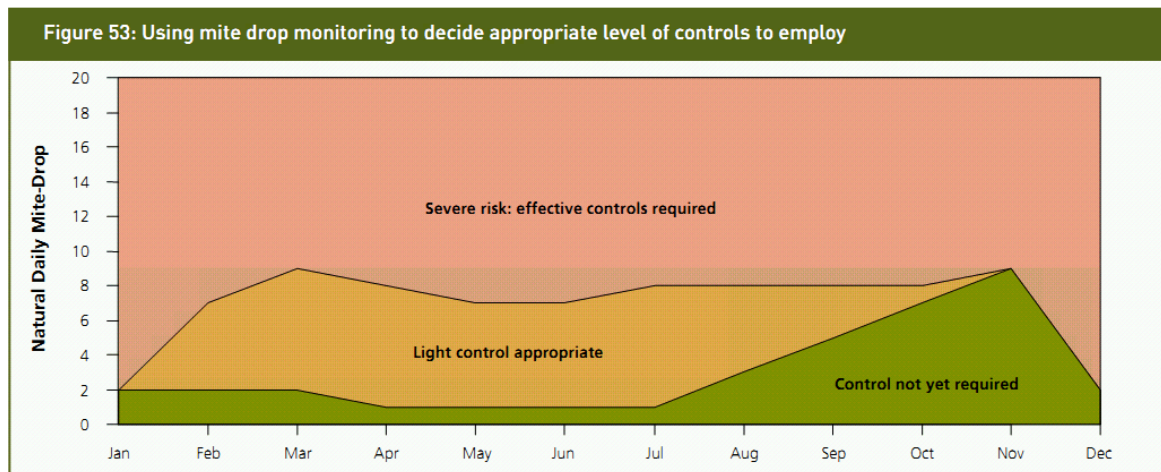
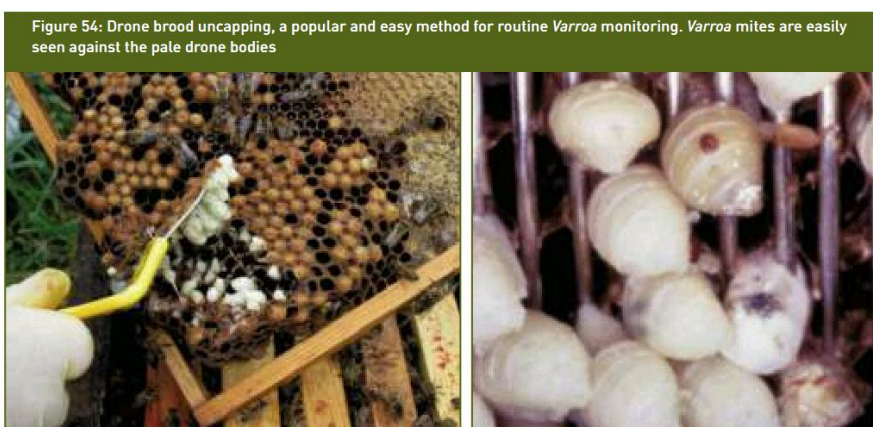


Table 5: Using drone brood monitoring to decide appropriate level of controls to employ

	Proportion of infested drone pupae		
April, May, June	Less than 2% (<1 mite in 50) No action	2% – 4% (Between 1 mite in 25 and 1 in 50) Plan controls for season	More than 4% (>1 mite in 25) Consider control
June, July	Less than 3% (<1 mite in 30) No action	3% – 7% (Between 1 mite in 15 and 1 in 30) Light control	More than 7% (>1 mite in 15) Effective control Severe risk
August	Less than 5% (<1 mite in 20) No action	5% – 10% (Between 1 mite in 10 and 1 in 20) Light control	More than 10% (>1 mite in 10) Effective control Severe risk



5.6 aware of the current legislation regarding notifiable diseases and pests of honeybees;

Principle legislation covering notifiable pests and diseases in bees is in the 1980 Bees Act. Empowers Ministers or Secretary of State to make orders to control pests and diseases affecting bees and gives Authorised persons the right of entry. FERA (Food and Environment Research Agency) is responsible for apiary surveillance and pest and disease control in England and Wales.

There have been several orders since the Act which list the pest and diseases which are notifiable. There are 4 and they are:

- American Foul Brood (AFB)
- European Foul Brood (EFB)
- Small Hive Beetle (*Aethina tumida*)
- Tropilaelaps Mites – any species

The order states (and I don't quote directly)

Any owner, person in charge, or person who happens upon the bees/apiary/container/transportation device (including hovercrafts!) who knows or suspects one of the notifiable pests or diseases is present must inform the Secretary of State

You must put apiary into standstill and not remove anything at all from the site that may spread the disease/pest except to send it for testing (and you must pack it in such a way that nothing spreads) until you have confirmation that the pest/disease is not there. Do whatever told to do by the authorities.

An authorized person may mark anything and you may not interfere with that mark.

The Secretary of State may declare an infected area and implement control measures.

A notifiable pest or disease may be tested at a Laboratory or with a field kit. If they find the pest/disease they can serve a notice requiring the destruction or treatment of Bees/ Hive/ Equipment/Transportation Device. The notice can be served on the owner of whatever the pest/disease is found on or in. If treatment is carried out but the disease remains they can serve more notices.

These notices state the method to be used and the date they must be done by. Also it may state that the actions may need to be carried out by or under the supervision of an authorized person.

You must not disguise/cover up disease. You must comply with the notice and if you don't then the authorized person will carry out whatever needs to be done at your expense. If you are prosecuted you can be fined up to level 5 (currently £5000)

Varroa is no longer notifiable as it is considered endemic

If you import bees you must have the attendant bees and queen cages etc tested.

5.7 aware of the national and local facilities which exist to verify disease and advise on treatment;

There are a number of diseases that bees are susceptible to.

The two most prevalent diseases being American Foul Brood (AFB) and the European Foul Brood (EFB) disease.

These diseases are reportable under law. AFB and EFB come under the bee disease Control Order of 1982. In essence this states that any beekeeper who suspects the presence of AFB or EFB must contact the local office of the relevant agricultural department. In practise this is the National Bee Unit or the Regional Bee Inspector/ Seasonal Bee Inspector, who will arrange to have the colony examined on site. In the meantime, hives should not be opened.

The NBU can be contacted at:

National Bee Unit,
The Food and Environment Research Agency,
Sand Hutton,
York
YO41 1LZ.
Tel: 01904 462510
Email: nbu@fera.gsi.gov.uk

Further details can be found on the NBU website at www.nationalbeeunit.com

The NBU at York are divided into eight Regional groups covering England and Wales. These are: Northern, Western, North East, Eastern, South West, Southern, South East and Wales. Scotland has their own bee health strategy.

Buckinghamshire comes under the Southern Region and the bee inspector for this region at the present time is: Nigel Semmence who can be contacted on Tel: 01264 338694 or email: nigel.semmence@fera.gsi.gov.uk

Seasonal Bee Inspector Julian Parker, 01494711782 or 07775119469 julian.parker@fera.gsi.gov.uk

The beekeeper could always contact an experienced colleague or club member for advice. The Regional Inspector will always inspect and give guidance on a colony and recommend a course of treatment if required.

5.8 aware where to obtain assistance if any poisoning by toxic chemicals is suspected;

Plants producing poisonous nectar is rare but *Rhododendron thomsonii* in large quantities killed colonies outright in 1955 in Scotland.

The use of agricultural sprays and spraying from domestic pest controllers are the main poisoning problems. If growers of crops follow the advice of FERA (Food and Environmental Research Agency), considerable loss of bees can be avoided, they need to time the application when crops are not in full bloom and apply the least toxic pesticide to bees. Ted Hooper(2010) suggests there be collaboration between farmers, spray contractors, beekeepers and pesticide firms at national and local levels.

Signs of poisoning

Deaths at hive entrance occurring within an hour

Spinning on the ground

Poisoned bees being repelled at the entrance to hive

Numbers of deaths vary but shovels full of foragers amounting to 15,000-30,000 bees

Nasty tempered

Can easily be confused with starvation or paralysis

If poisoning is suspected collect 3 samples of 200-300 bodies packed into a cardboard box. Send one sample to NBU (National Bee Unit), for analysis, putting the other samples in the freezer, but also provide as many details as possible if known, about the crop sprayed, time of day, method of spraying e.g. tractor, aircraft and the insecticide used. This information adds to statistics of pesticide poisoning and helps prevent further occurrences but also aids claims for loss of colonies.

Some areas have spray warning schemes allowing the beekeepers some time to protect their apiaries. Bees do not like to be shut in as this can cause over heating but creating a 'natural catastrophe' such as building up long cut grass/nettles over the hives causes them to fuss rather than forage.

5.9 able to describe how comb can be stored to prevent wax moth damage;

Beeswax is eaten by the larvae of the Greater and Lesser wax moths.

The Greater wax moth chews grooves into the wooden hive surfaces where it pupates. It prefers to eat brood comb, as it appears to need as part of its diet, bees faecal matter and old cocoons. The lesser wax moth will also target stored supers.

Combs should never be sprayed with any kind of moth killer or insecticide, as the beeswax absorbs the chemicals which will prove fatal to the colony the following season.

Wax moths like warmth and dark, so avoid both:

Supers can be stored wet with honey, but this is not ideal (crystallisation and growth of yeasts)

Acetic acid (80%) fumes will kill adult moths and their eggs.

Certain can be sprayed on both sides of brood comb before storing.

Small quantities can be frozen overnight.

Dry supers can be stored outdoors if protected from mice and the weather.

Place each frame in cling film or plastic bag and seal, storing in a cool place.

5.10 able to describe how mice and other pests can be excluded from the hives in winter.

Mice are the main pest of colonies in winter as they look for somewhere warm and dry to spend the winter months. The easiest method to keep them out is to lightly tack on the perforated zinc or plastic strips sold for the purpose by equipment manufacturers. Do not use Queen Excluder's as, although effective at keeping out the mice, they knock off too much pollen from the bees legs, when the value of fresh pollen is at a premium. If you make your own guards the crucial measurement is 10mm.

The guards are usually put on once the bees have been fed for the winter in September.

In some areas, especially with lots of trees, woodpeckers can be a problem, as the bees inside the wooden hive are not too dissimilar to the birds other insect prey beneath the bark of a tree. It seems that it is only the Green Woodpeckers that are the culprits, and then only once one discovers what a valuable food source your hives are, after which those bees not providing lunch, are killed by the weather and other predators given easy access by the large holes in the sides of the hive.

Covering the hives with wire or nylon netting is the usual preventative method. Hanging strips of plastic or cloth loosely down the sides of the hive from the top also works well.

Fencing around apiary to keep out livestock.

Whatever method used must be in place before the first frosts.