# BBKA BASIC ASSESSMENT SYLLABUS

# MBBKA 2024
# Basic Assessment Study Notes

**Developed by member of the Mid Bucks Beekeepers Association**

Candidates are required to obtain a mark of 50% in each of the following 4 sections:

1. **Manipulation of a honey bee colony and use of equipment (practical assessment)**
2. **Natural History and beekeeping (oral questions)**
3. **Swarming, Swarm control and effects (oral questions**
4. **Diseases and pests (oral questions)**

## 1.0 MANIPULATION OF A HONEYBEE COLONY AND EQUIPMENT (Practical Assessment)

**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 keep the bees as calm as possible. Avoid banging the hive parts together.
- Consider weather conditions - cold, windy, thundery conditions can have an adverse effect on the temperament of the colony.

**1.2 the reactions of honeybees to smoke;**

- Bees react as though a fire threatens the colony: they prepare to abandon the hive by ingesting nectar/honey; in doing so they fill their honey stomachs, becoming heavy and less inclined and able to sting.

- Make sure that the smoke is not too hot and that you don't apply too much, as the bees may react badly.
- Wait a few moments after smoking to let the smoke take effect before opening the colony.

**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, container with washing soda for cleaning equipment, container, with a tight fitting lid, for removed brace comb.
- Occasional use – queen cage, queen marking pen and cage, bee brush.
- Must clean equipment in washing soda between hives and after apiary visit.
- Beekeepers are a conduit for the spread of disease.
- Suit should be washed frequently with washing soda and detergent but **no** fabric softener.

**1.4 the reasons for opening a colony;**

- To check whether "queen-right", stores sufficient and to check for disease.
- To check whether the colony has enough space.
- To check that the colony is not preparing to swarm.
- To check the results of previous manipulations.
- To perform new manipulations to achieve specific objectives.

**You should always have a reason and a plan for opening a colony.**

**1.5 the need for stores**

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

**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 the bees at the entrance before smoking in order to recognise normal behaviour. Crack the brood and queen excluder and smoke into the gap or smoke through the open varroa floor.
- Work from the back of the hive if the frames are orientated in the "warm" way and to one side if the frames are orientated in the "cold" way.
- Put the roof upturned on the ground and put supers on it, with the crown board on top of the supers to prevent robbing and to keep the bees in the box.
- Check the underside of the queen excluder (or crown board) for the queen; return her to the brood box if she is there.
- Remove a frame to give enough room to work and prevent "rolling" the bees.
- Demonstrate that you are aware of the use of cover cloths, which prevent more bees from flying up and help maintain the hive temperature.

- **IF YOU USE COVER CLOTHS MAKE SURE THAT THEY ARE CLEAN**
- Demonstrate that you are aware that sometimes a spray of tepid water can be a better way of controlling bees than smoke, as it calms them, whereas smoke can panic them.
- Put frames back in the brood box in the order in which you found them (unless carrying out a specific manipulation).

**1.8 demonstrate lighting and the use of the smoker;**

- Demonstrate that you are aware that veils and gloves should not be worn when lighting 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.
- Give a few puffs of smoke at the start of the inspection and wait for it to take effect.
- Keep the smoker alight and keep it close at hand.
- Use the smoker occasionally and wait for the smoke to take effect if the bees become too agitated.
- Demonstrate how to use smoke to control bees and to drive them down into the hive before you replace parts.
- Know how to put the smoker out safely; blocking the top with grass is a good method.

**1.9 demonstrate the use of the hive tool;**

- Keep the hive tool in your hand at all times.
- You can use it for a variety of purposes: as a scraper, and as a lever for boxes and frames.
- It is good practice to wash it in washing soda between inspections of different 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 a frame or a dummy board at an outermost edge to make space to work.
- Demonstrate how to store removed frames properly, perhaps in a spare brood box, carefully propped against the hive or even leaning against the queen excluder, which might itself be leaning against the hive entrance.
- Do not "roll" bees, but use space to move frames along then slowly lift them out.
- Once they have found her, some beekeepers temporarily trap the queen in a matchbox or queen cage to avoid losing or damaging her but this is not required for the assessment.
- Recognise and comment on brood pattern (colour, age, type, etc.), brace comb and spacing.

**1.11 identify the two female castes and the drone;**

- Females – workers and queen (or tell-tale signs of the Queen)
- Drones - males, larger, large eyes, longer wings, hairy

**1.12 identify brood at all stages;**

- Eggs, larvae, pupae (sealed in cells). Remember the ratio 1:2:4.

**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 as pollen is included to allow the larvae to breath.
- Drone cells have a larger, domed surface area and are deeper (longer) too

**1.14 identify stored nectar, honey and pollen;**

- Nectar is clear and uncapped.
- Honey is capped – paler cappings.
- Pollen is uncapped and a range of colours, may have a thin layer of honey over the top of it.
- 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. the hive roof) or use a populated brood frame appropriately while you place the open part of a matchbox over some bees, close it and then remove it from the surface. You need to collect 30+ bees. The bees should be older worker bees and so don't take from about open brood.
- You might also be able to collect bees from the hive entrance after an inspection as they have a tendency to gather on the hive wall.

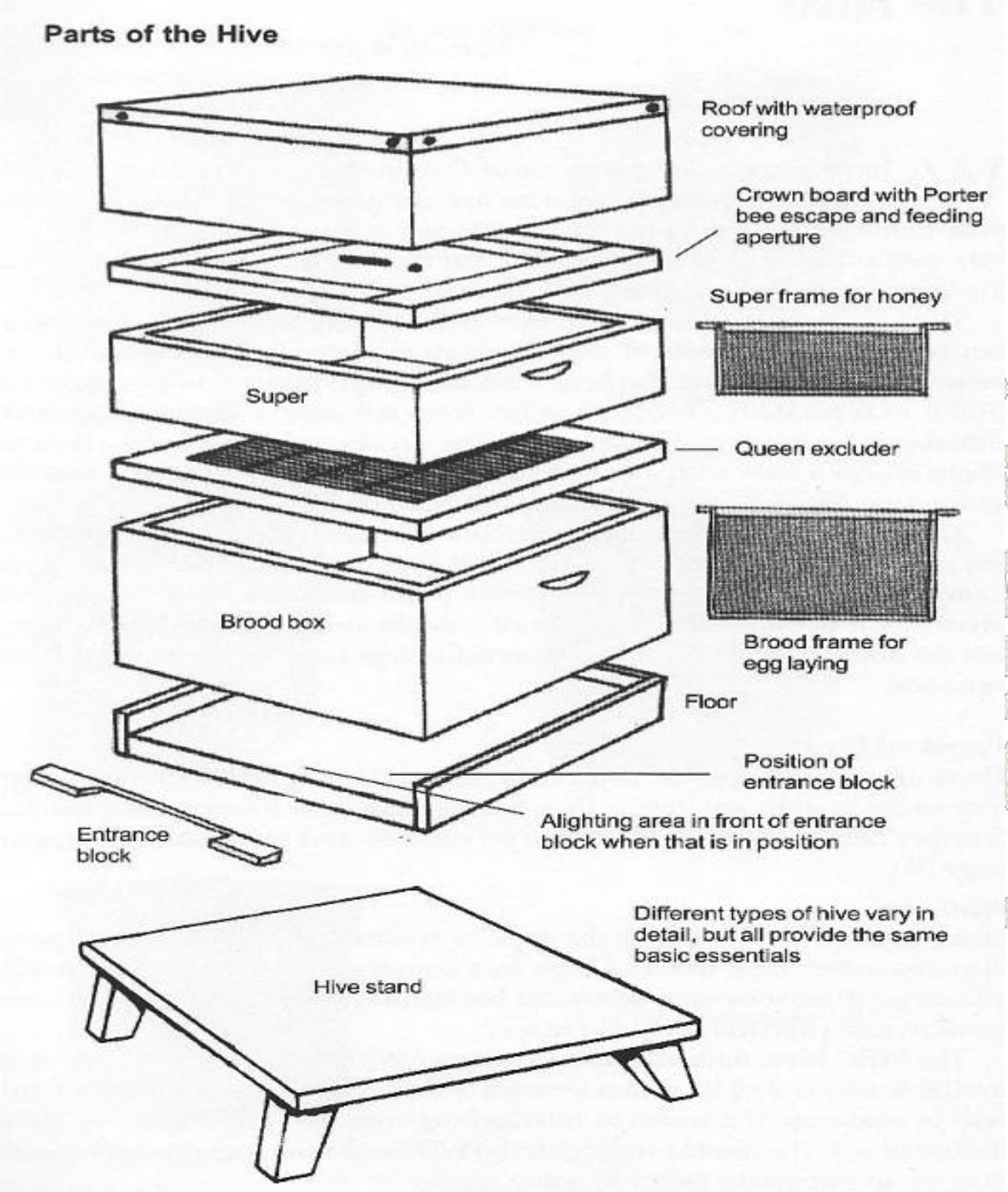
**1.16 state the number of worker bees required for an adult disease diagnosis sample;**

- 30 or so live bees (for nosema testing)
- 2-300 dead bees for suspected poisoning, most likely found outside the hive. If possible, take two samples: one to send for testing and the other as insurance if the first one goes missing. Samples can be kept in a freezer.

**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 a frame while it is still low in the brood chamber
  - Hold lugs firmly
  - Jerk firmly downwards with a definite "stop", avoid hitting sides as you do so
- To remove all the bees you might need to do this a second or third time

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




**1.19 discuss 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 build comb in it.

Rev. L L Langstroth noticed this in 1850 in Philadelphia, USA. He concluded that the distance between each wax sheet should be constant and uniform, and about 7 – 8mm for the western honeybee.

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 important bodily contact.

His theory about bee space revolutionised beekeeping. Langstroth constructed the first modern hive, using moveable frames to hold the comb within the hive.

His design enabled the queen to be confined to the brood box while the other bees had the freedom of the whole hive. It meant that honey could be stored in one part of the hive while brood developed in another, thereby enabling the beekeeper to harvest honey without brood mixed in it and to take comb out of the hive without endangering the colony.

Some hives are "top" bee space and some are "bottom" bee space. The National is usually bottom bee space, which means that the space for the bees to crawl through to get around the hive is below the frames. The Langstroth is top bee space; the space for the bees to crawl through to get around the hive is above the frames. Do not mix top and bottom bee space hive parts.

**1.20 be 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 might regard it as a chore, but with proper preparation and a methodical approach, the work itself passes uneventfully and the stack of new frames is constructed easily and quickly.

First prepare a suitable work surface: one that is sturdy, solid and large enough to stack all the parts on while you work on them. Have empty hive boxes available nearby: you will stack frames in them as you finish them.

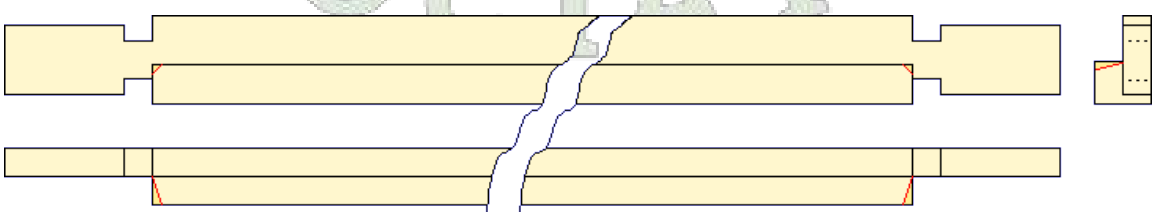
Treat frame assembly and the fitting of foundation as two separate jobs. You can assemble frames to the first stage at any temperature, but you should fit foundation and complete assembly indoors or in a heated shed.

Before starting to assemble a frame make some preparations:

First lay all the tools out in a pattern that allows you to find them easily

Then unpack all the top bars 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.

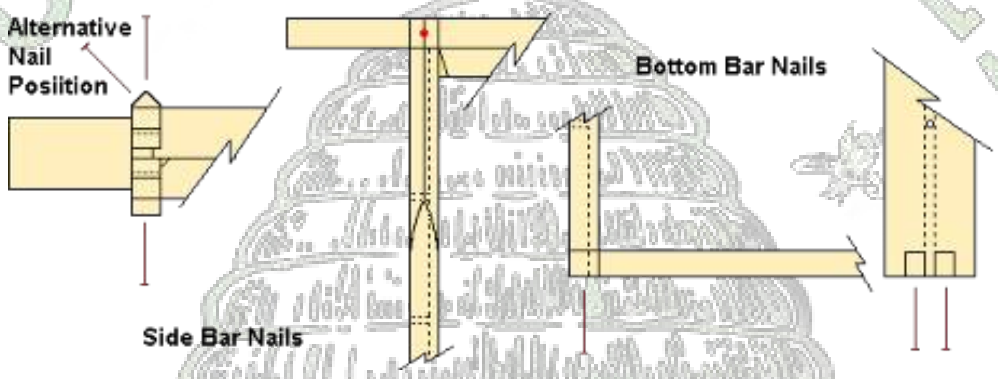


Also remove the sliver of wood that still adheres to the wedge. Repeat this operation until all top bars are processed.

Before you assemble and nail the frame together, consider what nails to use and where to put them.

Most beekeepers (and all major equipment manufacturers) suggest using 19 mm Gimp Pins (1 mm Dia Parkerized and stained) for the assembly of the frames. Some find power stapling machines handy for putting frames together, but there is little benefit in speed and the staples are relatively expensive. However, there is an advantage in grip as staples up to 32 mm in length can be used.

**Nail Placement**




The most common mistake is to nail the bottom bars 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 bottom bar individually into the end grain of the sidebar you will be able to pull the nails out easily when you want to put fresh foundation in the frame in 3 or 4 years' time.

Another mistake is to drive a nail vertically downwards into the side bar. The nail head impedes the scraping action of the hive tool when used for cleaning burr and brace comb from the top surface of the bar. In addition, the grip of the nail in the end grain is not enough to support the weight of the comb.

The assembly process:

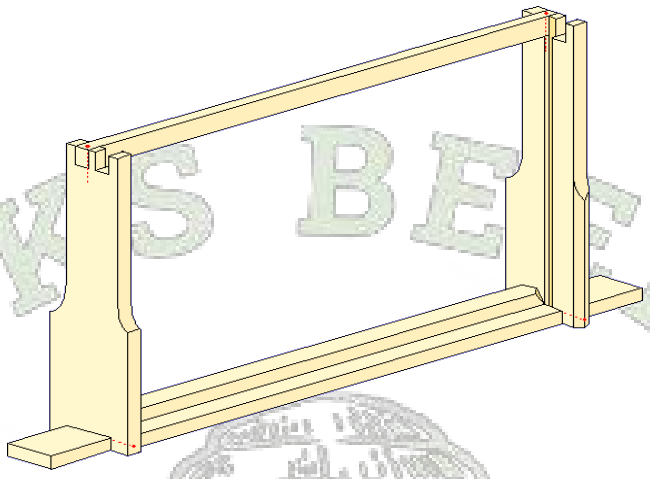
Take a top bar and two side bars and push the notches in the side bars onto the narrow necks of the top bar, ensuring that the grooves in the sides (if any) face inwards. The side bars will stay in place as they are a tight fit. (If they are too tight, use a craft knife to adjust them.)

With the top bar 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 top bar at the points where the sidebars sit: this ensures firm seating of the bridle joints.

Lay the assembly flat and put the nails for this side of the frame in. Turn the frame over and insert the other two nails.

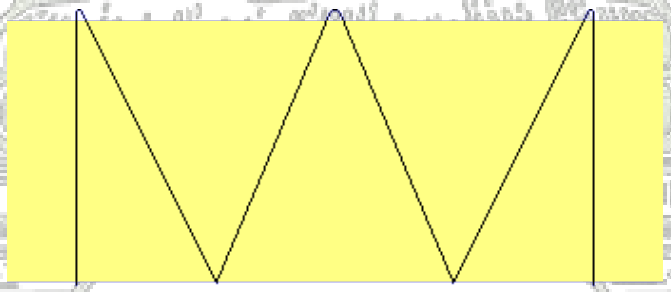
Next, with the top bar resting on the bench and with the sides pointing upwards add one bottom bar (on the same side of the frame as the non wedge side of the top bar). The ends of the bottom bar must be exactly flush with the outside face of the sidebar.

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 are in the positions shown 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. The next operation is the fitting of the foundation and the last bottom bar



**This Way up When Fitting**

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. (Bees tend to build accretions of wax on any exposed wire; if you attempt to remove this wax with your hive tool you will find that the wire will snag the tool and be pulled 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:

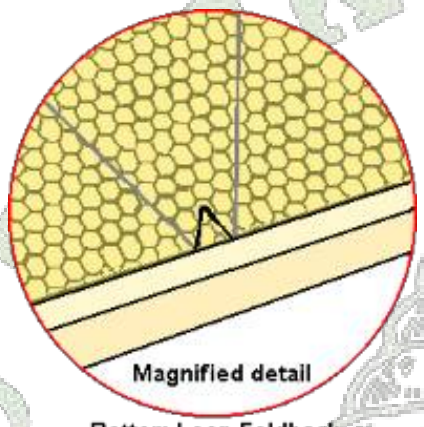
Lay the part finished frame flat on the bench with the single bottom bar downwards.

Slide the foundation into the grooves with the wire ends or loops uppermost. (The foundation must slide freely in the groove: trim a small strip from one side if necessary)

Fit the wedge bar to trap the protruding wires or loops and nail 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. (The points of the nails would impede the hive tool during normal frame cleaning if they protruded.)

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

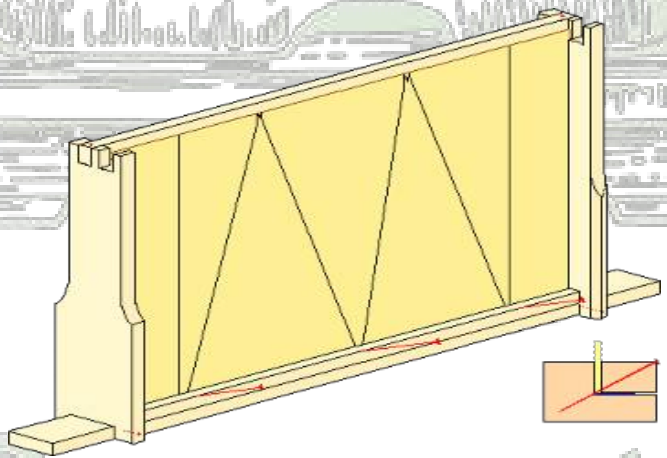
Fit and nail the second bottom bar, being careful not to buckle the bottom edge of the foundation.



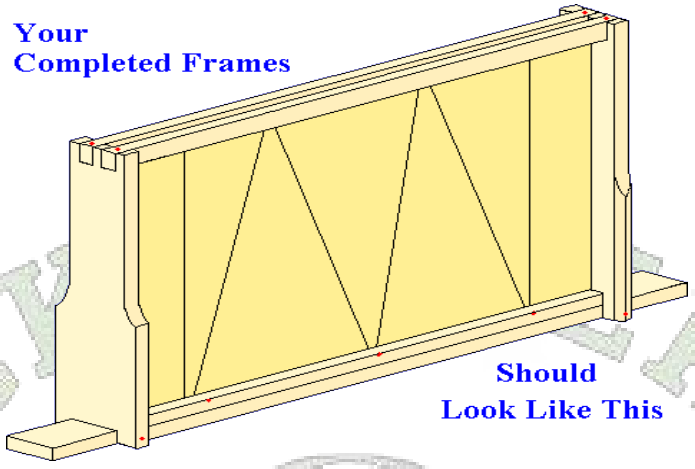

Bottom Loop Foldback

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.




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 wiring is that it makes the comb 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 many advantages in using foundation, such as:

- 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.
- It makes harvesting easier; its regular shape speeds the process up.
- It changes old foundation for new quick (and so helps to keep disease at bay).

**1.21 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 in the brood chamber**

In a wild bee colony, the spacing between brood combs is always very regular at 30-32 mm: this distance allows two bees working on faces of adjacent combs to pass each other with just their wings brushing while they tend the brood. Spacing brood frames more than 37mm apart gives problems with thermoregulation and hence less brood. Frames containing foundation (for drawing) should also be spaced no more than 37mm apart (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 that extra frame in. It is difficult lever it out without damaging it once it is drawn and contains honey. Using a dummy board gives space for manoeuvring the frames without damaging 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 com, which causes lots of problems. Removing it can be time consuming and messy and queens are often accidentally damaged in the process.

**Frame spacing - super**

There is much more flexibility in spacing frames in 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 apart) to 8 frames per box (51mm apart). The bees will extend the cell walls and make the combs

fatter. This is referred to as 'drawing the combs wide'. The 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 they are more difficult to manipulate and uncap during extraction.

**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, 10 and 11 frames per box.

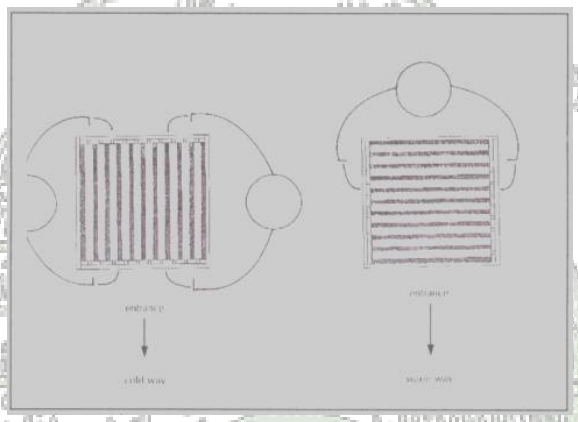
**Hoffman self-spacing frames** have a fixed spacing of 35mm. When the frames are pushed tightly together the spacing between them will be correct for the bees, the foundation will be drawn out evenly and the combs will be easy to remove for inspection. If the frames are not pushed tightly together then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

**End spacers** are the most flexible method of frame spacing because they enable a box to be reconfigured readily. 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. Spacers might also fall off at the wrong moment or get gummed up with propolis.

**Castellations** fix the frame spacing in a box, so are not as flexible as end spacers. They are not ideal for brood because castellations force frames to be lifted vertically before they can be moved laterally; this action tends to “roll” bees. Castellations are ideal for honey supers because they hold frames very firmly and do not let them rub together and leak honey whilst in transit. Castellations also minimise the build-up of propolis.

## Tips on the Practical:

1. Ensure that you have a clean bee suit and gloves.
2. Clean your hive tools and gloves in bucket of washing soda provided.
3. Light a smoker using the best fuel, and take time to ensure that it will burn for 30 minutes.
4. When approaching the hive and before smoking, check the entrance for activity; if pollen is 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 (roof). Take your time before opening the hive. Use the smoker sparingly.
6. Open the hive and put supers on the up-turned roof. Place the cover board on top of the supers to keep the bees quiet and reduce robbing by bees from other colonies.
7. When inspecting you should stand either behind or to the side of the hive depending upon whether the brood frames are orientated in the warm or cold way.



8. Remove the queen excluder; check to see whether the queen on the underside; place the queen excluder on the ground propped against the side of the hive close to entrance.
9. Working from the side nearest to you, remove the first frame and check whether brood are present on it. If not, place the frame on the ground in front of the hive or hang it from the stand. Talk your way through what you are doing.
10. All the hives in the apiary (with the exception of the poly hives) are bottom bee space. You may be asked to state whether the hive is top or bottom bee space. For top bee space there is ¼ inch gap above the frames; for bottom bee space the frames 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 whether you believe that the stores are sufficient.
13. Finding the queen is not essential but you will need to find evidence that the colony is “queenright” (all stages of brood) and should state that.
14. If asked to show how you would examine a frame for disease:
    a. Shake the bees off a frame (one without the queen on it) by placing the frame in the space in the brood box and jerking it downwards without knocking it on the sides or other frames; repeat until all or nearly all bees have been removed.
    b. Describe what you are looking for; distorted larvae, sunken cappings – anything that does not look “normal”.

c. Explain what you would expect to see if there were healthy brood

15. If asked to take a sample of bees for disease testing:

a. You are looking for older bees; these will be bees furthest from the brood, say in the outer frames

b. Use a large match box

c. Open the match box and hold it against the frame

d. Gently run the matchbox along the frame and close it

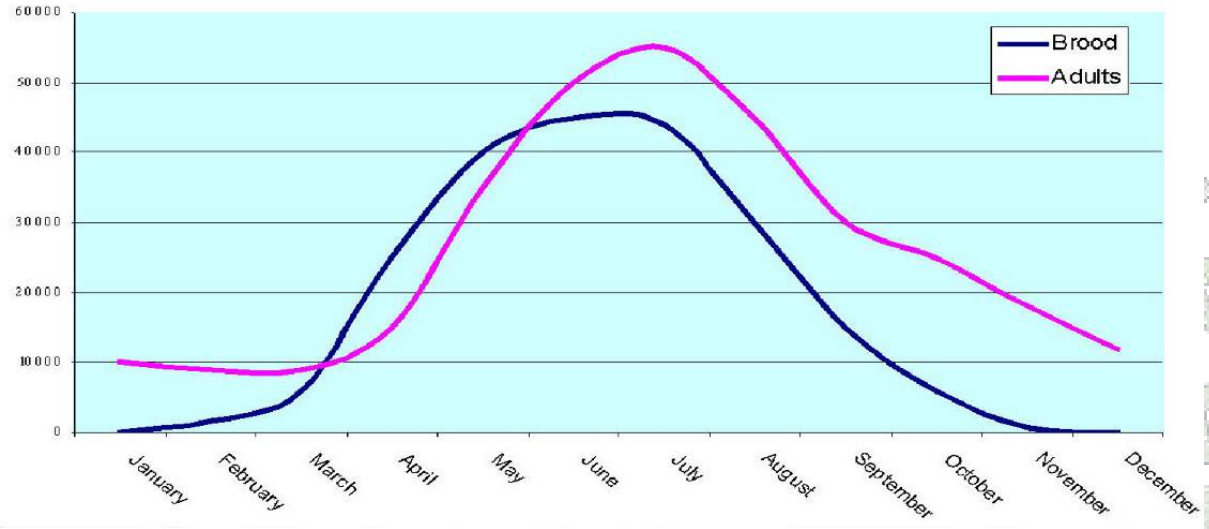
**e.** A sample of 30 bees is required

## 2.0 NATURAL HISTORY OF THE HONEYBEE

## The Candidate will be:

**2.1 able to give an elementary account of the development of queens. workers and drones in the honeybee colony ;**

The population of the colony fluctuates throughout the year:




There are 2 castes of female bee plus the male drones.

- Workers are produced from fertilised eggs laid by the queen in worker cells. They have 32 chromosomes and are female but their reproductive capacity does not develop fully. When the egg hatches into a larva nurse bees feed it brood food, pollen and honey until they seal its cell on day 8. The larva moves through the larva/pro-pupa and pupa stage to emerge as an adult bee after a further 13 days, 21 since the egg was laid.

- Queens are produced from fertilised eggs laid in queen cups that look very much like peanut shells. They have 32 chromosomes and are female with full reproductive capacity. When the egg hatches into a larva (day 3) the nurse bees feed it continuously with royal jelly until they seal its cell is on day 8. The queen emerges after a further 8 days on day 16. She is sexually mature and ready to mate 4-5 days after emergence.

- Drones are produced from unfertilised eggs that the queen lays in specific drone cells. They have 16 chromosomes (haploid) and are male. The nurse bees seal their cells after 10 days and the drone emerges after a further 14 days on day 24. They become sexually mature 12-14 days after emergence.

During the spring to summer build-up the colony may swarm. In order to be able to swarm the colony produces new queens. The old queen leaves with the swarm to find a new nest site.

In the spring the colony produces drones in small numbers, reaching a peak of some 300-2,000, and then evicts them after the honey flow when they have completed their mating function and the colony prepares for winter.

The colony consists of:

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

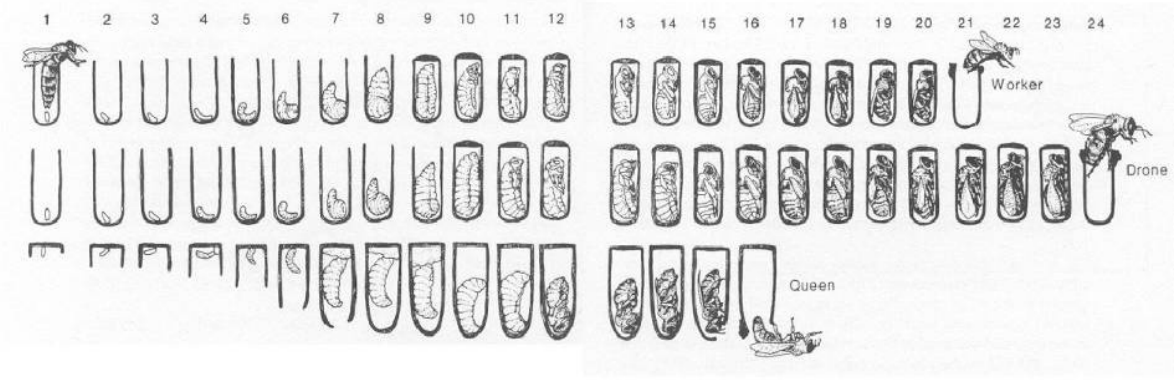
**2.2 able to state the periods spent by the female castes and the drone in the four stages of their life (egg, larva, pupa and adult);**

| | Worker | Queen | Drone |
|---|---|---|---|
| | days | days | days |
| Open Cell | | | |
| - Egg | 3 | 3 | 3 |
| - Larva | 6 | 5 | 7 |
| - Sub total | 9 | 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.

A good rule of thumb on brood proportions during inspections: the ratio of worker eggs to larvae to sealed brood should be 1:2:4, consistent with the periods in the development of the egg 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*

**2.3 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 |

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 and quantity of a crop. For instance a poorly pollinated watermelon will not become sweet, and pollination failure in apples will cause blossoms and unripen fruits to drop, with any fruits reaching maturity being smaller, misshapen and containing fewer seeds. Some vegetables such as brassicas may produce a crop but without pollination they would be unable to produce fertile seeds for the next generation.

Insect pollination indirectly affects other food production. 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 depends greatly on insect pollination.

Although not the only pollinating insect, bees are responsible for pollinating up to 80% of flowering crops. Unlike other insects that do not overwinter *en masse*, the honey bee is available for pollination duties in great numbers early in the season and is estimated to contribute £165 million to the UK economy through pollination alone each year[1]. This equates to £600 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.

[1] ADAS report for DEFRA 2001

What makes honey bees good pollinators is that they are systematic and focus upon a single variety of crop or plant; if they find a nectar source to be of good quantity and quality, they recruit more foragers to it.

**2.4 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 about 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 their straw-like proboscis, worker bees drink the liquid nectar and store it in their honey stomachs. A bee continues to forage, visiting hundreds of flowers, until its honey stomach is about 40% full.

Within the honey stomach, enzymes break the complex sugars of the nectar down into simpler sugars (glucose and fructose), 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 breaks the sugars down further. 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 the air through rolling a drop on its tongue (proboscis). The bees hang nectar in cells and fan it to evaporate water and reduce its content to below 20%. As the water evaporates from nectar, the liquid thickens into honey. Once the honey is finished, the hive bee caps the cell with wax, sealing the honey into the honeycomb for later consumption.

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

<u>Pollen</u>

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

Expansion of the colony depends upon the availability of an adequate supply of nectar, but possibly even more so 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 welcome sight for the beekeeper to see bees bringing this colourful ingredient in; the colour of pollen can vary from a bright orange to yellow, dependent on the flower.

Pollen foragers collect pollen. Grains of pollen attach themselves to the hairs on the bee; the bee scrapes them into 'pollen baskets' (corbicula) on its back legs. As the bee moves from flower to flower, some grains are detached and pollinate them.

<u>Water</u>

Bees must remove water from honey for storage, but they must add water to honey to make it fit for use (consumption) by the colony.

70% of initial worker brood food is water.

Bees do not cap cells of honey until the water content is less than 20%, otherwise it will ferment.

They use water to cool the hive when the air is very warm. Bees fan tiny droplets around the hive to cool it by evaporation. The bees maintain the humidity within the hive at 40-50%.

Propolis

Propolis is a hard resinous substance that bees harvest from tree buds, sap flows, or other botanical sources. They use it for several things:

- Fill holes and gaps.
- Strengthen the base of comb where it attaches to hive.
- Mummify dead creatures too big to be removed from hive.
- Polish cells before the queen lays in them; propolis is antiseptic.
- Varnish and so strengthen the wax comb.

Propolis is believed to have healing properties and it is used in alternative medicines.

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

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

The cluster is about the size of a football, expanding and contacting with the outside temperature. The bees take it in turn to be on the cold outside.

Honey bees are cold-blooded. They are active throughout the winter, eating honey (a colony needs 40lb to survive an average winter), syrup or fondant to survive. The colony produces winter bees at the end of the summer. They contain more fat bodies and have a different blood protein profile than that of summer bees, 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 lack of brood to care for helps the survival time.

The sole purpose of the winter bee is to get the colony through until spring. The population of a colony drops off as summer bees die and are replaced by a smaller number of winter ones.

Brood production stops when outside temperature fall below flying temperature, the bees do however take cleansing flights (to empty their rectums) when temperature rises.

If the temperature drops too low the bees will not move and may die of starvations, 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.

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

Home or out apiary

Home Convenient, all tools etc. nearby; there no distance to travel

Easy to watch the outside of the hive: fun and informative.

Might upset neighbours; liaise with neighbours before getting bees.

Might cause spotting on washing during cleansing flights.

Out Bees are less likely to disturb anyone.

Usually lots of room

Must transport tools; often forget something.

Transporting heavy supers/hives difficult

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) without 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/shaded)

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 a good natured nucleus – easier to work with

Ensure bees are healthy and the colony is strong.

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

Register with BeeBase (or update details)

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

Hives should have some sunshine and some shade – to protect them from intense heat – those that receive too much of either will under-produce. Avoid low-lying areas where moisture and cold settles. Locate hive a safe distance from animals such as horses, cattle and badgers, which may be inquisitive of smell or appearance and knock hives over. Bees may attack and even kill an animal - potentially leading to legal action against the beekeeper.

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

Take public access and right of ways into consideration; it is not a good idea to have hives too close to passing public. Ideally you want to site hives more than 8 meters from public access – which should be at a safe distance with a barrier such as a hedge. No hedge or barrier 15+ meters – erect a barrier if you are permitted to do so. Local authorities may not permit hives on their sites, so you must check before you put any there.

Should the back garden or your chosen location not be suitable, consider the countryside, farms, pasture land, wasteland, orchards - but get the farmer's permission first, of course. Most farmers would be happy to have hives on their land as your bees help to pollinate their crops. However, do ask the farmer to let you know a week before hand if he or she intends to spray crops near your hives, so that you can protect your bees from potential poisoning by shutting them up or removing them from the site.

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

**Setting up and arranging your apiary:**

Elevate hives – place on a hive stand, a stand of bricks and treated wood or a metal frame.

To reduce drifting and hence the transfer of disease, you could stagger hives – arrange them in a semi-circle, or around trees and bushes.

If the hives are in a straight line, mark their entrance blocks with different patterns in order to enable bees to identify their hive amongst others.

Ensure that hives are ventilated – damp hives harbour disease.

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

Consider sources of nectar, pollen and water; there can be an abundance even in towns and cities with fruit trees, flowers, vegetable, even weeds. Bear in mind that bees forage in an area of more than 10 square miles. Remember to put water within close range of hives in built-up areas – so that the bees do not pester or disturb your neighbours as they look for water.

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

**2.8 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 your neighbours' enjoyment of the countryside or their gardens (e.g. not in the flight path of their washing line)
- Consider the direction of the hive entrance, as there will be activity up to 1m in front of it.
- Cover sandpits.
- Erect or use barriers in front of hives to force bees to fly up above head height as they leave the hive.
- Avoid sites bordering roads where pedestrians or riders might pass.
- Try to make sure that the hives are not visible to passing walkers or traffic. Hives sometimes get stolen or vandalised.
- Take steps to avoid swarming.
- Fence out-apiaries off from livestock.

**2.9 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 bee-suits with no sting pheromone

**Carry a mobile phone and know the post code or grid reference of your apiary.**

Immediate response when stung:

- Remain calm.
- Remove the sting as soon as possible. Venom is injected within the first 20 seconds.
- 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 – symptoms away from the sting site, systemic shock including breathing difficulties, swelling of lips, tongue, or eyelids, vomiting, dizziness, pain.

Treatment –

Mild reaction: Aspirin or antihistamines, ice area if swelling.

Severe reaction:

- Call ambulance.
- Remove from the area of the hives.
- Seat patient and ensure that they remain calm.
- Loosen clothing.
- Encourage deep breathing.
- Place in recovery position.
- Administer Epi-pen if carried by patient and use is confirmed by patient.

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

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

**Autumn and Winter**

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

A good-sized colony needs 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 you do not leave a full super on the hive, you will need to feed the bees syrup. Syrup should be quite concentrated - 1 kg sugar to 600 ml water - as bees are less able evaporate water in cool weather. Reduce the size of the hive entrance to prevent robbing. Heft the hive (lift it with a straight back) so that you can compare its weight in the new year.

Put mouse guards and woodpecker deterrents on before the first frosts. Bees will continue to fly on warm days, otherwise there will be little activity.

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

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

Once a month or after especially bad weather check that all is well in the hives and that their entrances are not blocked.

**January**

If the weather is mild, heft the hive to ensure that it has adequate stores. If it feels light, feed with fondant 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 that the area around the hives is tidy, remove mouse-guards and Woodpecker protection.

Check entrances to see that the bees are flying and busy. Feed them a little light syrup towards the end of the month to help stimulate rapid build-up.

**April**
The colony rapidly expands during April and the first drones may be produced, meaning that the colony is preparing to swarm (45 day warning!). Oil Seed Rape (OSR) can be in flower by the middle of the month; if there is some near your hive you will need to put supers on before then. All in all you will have to make regular, possibly weekly, inspections.

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?

Carry out a detailed inspection to check the health of your colonies when the weather allows. Choose a warm, still day with a temperature of 18°C or above (shirt-sleeve weather).

**May, June and July**
The summer build-up begins in earnest in May when the queen is likely to be at her most productive. Inspect weekly to prevent swarms. Extract OSR honey at the end of May or the beginning of June, as it crystallizes rapidly in the combs.

**August**
The colonies are under most threat from wasps and robber bees as the nectar flow falls, so reduce hive entrances to help the bees defend their stores.

Taking the honey harvest at this time intensifies the problem.

Carry out a detailed inspection to check the health of the colonies and treat for varroa.

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

- Spring and emergency feed 11b sugar 1 pint of water or 1.0kg to 1.25 litres of water
- Autumn feed 2 kg sugar 1.25 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 estimate its weight and take it into account when feeding. As a rule of thumb, one fully sealed brood frame will hold about 2kg of honey and a full super frame about 1.5kg.

Make syrup from ordinary granulated sugar; never use brown sugar or other types of unrefined sugar. You will need a large pan (for jam-making or similar). Put **1kg** of sugar into it for every **600ml** of water. Heat and stir

the contents at the same time until all the sugar is dissolved. Do not let it burn whilst heating it, as the bees may then not touch it and it might harm them if they did.

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

**Winter Feed:** Feed with fondant (candy) if stores are light later in the winter; you can get from a baker's or make it at home or buy purpose made fondant from equipment suppliers, this is often inverted and so easier for the bees to use; but more expensive. 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. Let the temperature in the pan reach about 120°C and use a jam-making thermometer to check. Take care not to burn the mixture. If you don't have a jam-making thermometer, put a drop of the boiling liquid onto a cold plate. When ready it will solidify immediately to a soft consistency. Allow it to cool but, before it sets, pour it into suitable containers: old margarine or ice-cream tubs will do, or metal trays lined with greaseproof paper. When the mixture has set, invert the feeders and place them over the feed hole with the fondant exposed to the bees.

**Spring Feed:** A spring feed may sometimes be necessary in order to stimulate the Queen to lay, to replenish stores when foundation needs to be drawn out or to cope with the 'June gap'. This feed should be syrup with a relatively low sugar content, i.e. about **1kg** sugar to **1.25 litre** of water.

**2.12 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. They need a lot of space for food stores as they need sufficient to see the colony through the winter when there is little forage and little opportunity to forage.

As the brood increases space in the main brood box for stores runs out and you should add supers to give the colony sufficient space for the stores that it needs.

Nectar brought into the hive contains 50 – 80% water. The bees reduce this proportion to 18% as they process nectar into honey. Because it contains more water, nectar takes up more space than honey, and when the nectar flow is strong the bees need space to store and process nectar as well as to store honey.

Timing

Add a super when the main brood box has 6 or 7 frames of brood and the bees cover 8 or 9 frames thickly when viewed from above. The timing of adding supers depends on how prolific the queen is, the weather and the availability of forage.

As a general rule of thumb, add a super when 7 out of 10 frames in the last one added are 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.

**2.13 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 the size of the entrance using a block.
- Ensure that there is no other entrance (e.g. through ventilation holes in the roof). Keep hives in good condition.
- Reduce the size of the entrance after removing the supers.
- Be aware of hygiene and the need for tidy beekeeping; don't spill sugar syrup or leave wet supers or honey lying around where bees can find them.
- Consider the apiary lay-out to prevent drifting.
- Feed in the evening and feed all hives at once.
- Protect the hive during inspections, e.g. by covering frames with a manipulation cloth.
- Consider moving a hive when there is silent or 'friendly' robbing.
- Ted Hooper suggests leaning a piece of glass against the entrance to confuse robbers. The occupants of the hive 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 further searching and further robbing.
- Wasp traps.

**2.14 able to describe a method used to clear honeybees from supers**

Canadian Clearer Board

A very effective and rapid way of clearing bees. The cones are not one-way valves but disorientate the bees sufficiently so that they cannot find their way back into the supers. However such boards should not be left on for more than six hours.

Porter Bee Escape

Invented in the USA by Mr. Porter in 1891. The basic principle is simplicity itself – it is a one-way valve. Place the escapes in the crown board slot/s with the top hole uppermost. Check that the stainless steel springs are 3mm apart. They allow the bees to pass through yet are close enough to prevent their return. Remove the queen excluder and put the crown board in its place below the super/s to be cleared. Bees leave the super, pass through the 22mm diameter hole and into the chamber of the escape. Once there the bees have two escape routes through the springs. If used properly, bees should clear supers over a 24 hour period. Requires good weather and a forage flow.


Bee-Quick

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.

**2.15a 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 customary time but sometimes honey is taken late Spring too. Choose a suitable hygienic, bee-proof room and cover the floor with newspapers. Wash your hands and have a bowl of water and a 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 wax particles out of 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 containers like dustbins with a tap at the bottom to run the honey off from time to time. They come in different sizes, can be manual or electric and radial or tangential; both types use centrifugal force to empty the combs of honey. Load the frames so as to balance the weight in the extractor or it will move around the room when running. 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 and jars need filling, wiping and lids applied.

Remove pollen, wax, bee parts, etc. by coarse straining. Stir occasionally for a steady flow and to prevent clogging.

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

If you intend your honey 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.

Clean up with copious amounts of cold water, and damp cloths for surfaces, etc. Return super frames to the hive for cleaning by the bees or store them wet in a safe place with honey securely covered.

**2.15b 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)for bottles but do not use hot water for washing items covered in wax (unless you would like your drains blocked!)

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 cleanable covering should be used.

The kitchen must have a sink with hot and cold water supplies and somewhere separate for washing 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.
- Keep dogs/cats out of the room and do not smoke.

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

You must not extract honey if you are suffering from any infectious diseases. Cover any cuts, grazes and sores with a waterproof dressing that it very visible. Wear vinyl gloves over waterproof dressings.

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 a nailbrush. Disposable paper towels are recommended.

Keep the work area clear and tidy; dispose of refuse as you go.

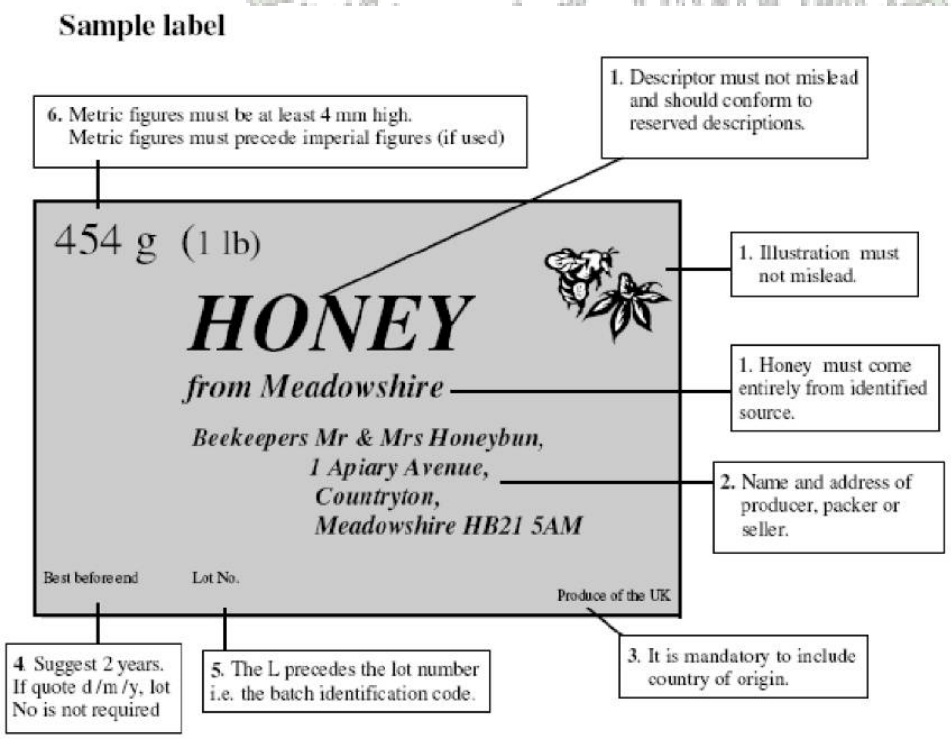
**the legal requirements for the labelling and sale of honey;-**

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 2015.

The honey label must comply with four sets of Regulations, The Honey (England) Regulations 2015, 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 has 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.




**2.16 aware of the various web based resources relating to beekeeping such as BBKA and Beebase.**

The internet contains a large amount of information about beekeeping: some useful addresses are:

BBKA - http://www.bbka.org.uk
Full membership of MBBKA makes you a member of the BBKA. Your BBKA membership number gives you access to the members-only area of the BBKA website

BeeBase - https://secure.fera.defra.gov.uk/beebase/index.cfm
BeeBase is the Fera National Bee Unit website. It is designed for beekeepers and supports Defra, WAG and Scotland's Bee Health Programmes and the Healthy Bees Plan, which set out to protect and sustain our national bee stocks. The website provides a wide range of free information for beekeepers, to help keep their honey bees healthy and productive. MBBKA encourages all members to register themselves and their apiaries on BeeBase.

## 3.0 SWARMING, SWARM CONTROL AND EFFECTS

# The Candidate will be:

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

Swarming is the colony's means of reproduction. Overcrowding and congestion in the nest predispose colonies to swarm.

When a colony prepares to swarm, it has reached a stage in its development where it can be divided into two. In a swarm, the old queen and up to half of the colony leave the hive and go in search of new quarters, leaving their old hive 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 or early Summer and it's possible for hives to swarm several times a year. When you see drone brood produced you should start preparations to prevent swarming.

Scout bees are workers who search out the best place for the swarm to live. They take into account 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 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 late 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 nor food stores with them to defend.

**3.2 one method of swarm control**

Think of the colony as being made up of 3 parts

1. the Queen
2. the brood and its 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.

<u>One week later</u>

- 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.

**3.3 able to describe how to take a honeybee swarm and how to hive it;**
**Capturing the swarm:**

**Equipment needed to capture a swarm:**

- A Skep or Swarm box
- A board slightly larger than the box
- A loose-weave sheet
- A wooden block
- A waste paper 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). Paint the box liberally inside and out with melted beeswax (use a hair drier to help the wax soak into the cardboard). Drill holes 4-4.5mm diameter 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 your bee suit on. 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 it in place.

Light the smoker in case it is needed.

Lay 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. You might have to secure the box in place with string. Use gentle smoking 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 moved into the box, gently invert it on the board. Put the wooden block under a corner of the box to provide an entrance. Fold the sheet over the box on three sides leaving the entrance side clear for bees to come and go. Capture any stray groups of bees using the waste paper basket and/or scoop, which you should shake in front of the box to release the bees near the entrance.

Next 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 bees will start to fan at the entrance. If the queen is not there the bees will move in the opposite direction and you will have to start the process again. It may take up to half an hour to be sure of the outcome.

Ideally leave the swarm in position until dusk when all the bees will have settled in for the night. Remove the wooden board and tie the sheet firmly over the opening. Turn the box over with the opening at the top to allow ventilation. You can then move it 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:

Put a board at least 18 inches (460mm) wide leading up from the ground to the entrance to the hive. Cover the board with a cloth that hangs down to the ground on either side. This prevents the bees from wandering off and forming a cluster on the underside of the board. The board should fit snugly against 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. The bees' instinct will be to move uphill and they should then find the entrance and start to walk in. Raising the brood box slightly to enlarge the gap also helps. 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 brood box 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 frames on top, they will sink down as the bees climb onto them, followed by a cover board and roof.

A queen excluder can be placed under the brood box for a few days to prevent the swarm leaving the next day!

**Aftercare of the swarm:**

Hive the swarm in a small hive and keep it that way (adding no supers) until the bees have drawn all the frames of foundation. Give the bees a generous feed of syrup to help them 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 draw all the frames at the same time in as little as 48 hours. Smaller swarms will attempt to draw only 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 re-arrange the frames, putting at least one drawn frame on each side of the box and frames of

foundation in the middle next to combs on which the queen has started to lay. You might have to repeat this manipulation until all the frames have been drawn.

When you have done this, remove the syrup, and then add a queen excluder and supers.

During the first three weeks the number of bees in the hive containing the swarm will decline. Numbers will increase only 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 larvae/eggs

An egg stands up in the bottom of a cell. By day three, the egg has lain 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 colony usually has a louder roar, and usually appears more disorganized than a queen-right one. If you do not see any eggs on any frames, then you have a queenless hive (Note: a queen may go off lay when treating for varroa so always check this).

Signs

- No eggs, larvae or capped brood cells (lack 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 eggs
- 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
- Workers making queen cells after several days indicates queenlessness

**3.5 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 used | only drones laid and worker cells used |
| 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 |
| Eggs | single egg per cell in bottom of cell | multiple eggs in cells, some on the sides |
| Queen | queen present | no queen or queen cell present |

**3.6 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 workers. 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 Butler cage is the most popular in the UK. It is made of wire mesh in the shape of a box, 94mm by 20mm by 12mm, bunged with tin or wood at one end and open at the other. Once you have placed the queen inside it, seal the open end with fondant (candy) or with newspaper held in position with an elastic band.

Place the queen snugly between two frames of brood where there are plenty of young bees. Do this by gently pressing the cage into the comb or by 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 fondant (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.

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

Uniting is the name given to the operation of combining two separate colonies to make one stronger colony. A weak colony consumes most of the nectar that 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 their honey-gathering potential and their 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.

Inspect both colonies. Check the queen that is to head the united colony to make sure that she is laying well. If there is worker brood the colony is said to be ‘queen-right’. Then inspect the other colony, find the queen and remove her. Pin a sheet of newspaper over the top of the brood body of the queen-less colony and take the brood body of the queen-right colony from its floor and place it on top of the newspaper.

Replace the crown board and roof on top of this double brood body to complete this first manipulation.

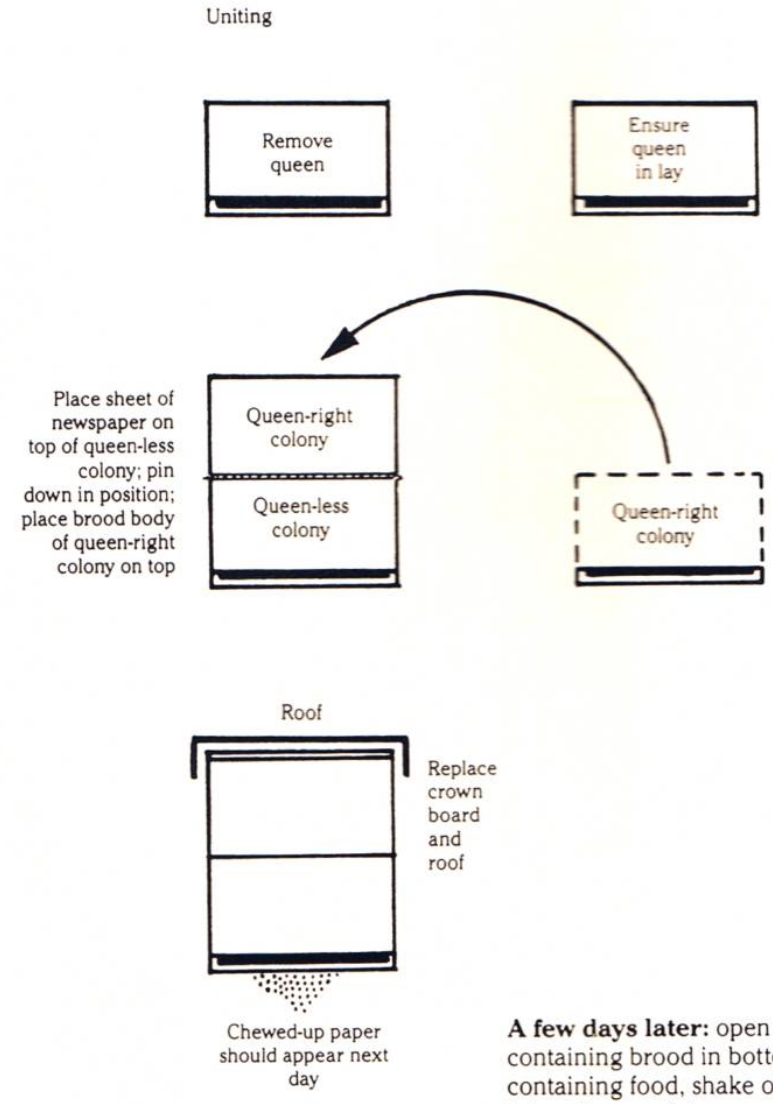
The bees in the top box find themselves imprisoned and start to chew their way through the newspaper. Some beekeepers stab a few small holes in the newspaper to ease the bees’ task, but this is not strictly necessary. By the time the two lots of bees have chewed through the newspaper the different smells 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 open the hive and reorganise the frames. Place the queen and all the frames containing brood together in the bottom brood body. Put frames of food on either side of the united brood nest to fill this and the second brood body, and take any extra frames away for storage.

Although the queen-right colony should be placed on top of the queen-less one, 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.

**3.9 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 or the 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 DISEASE, POISONING AND PESTS**
*The Candidate will be:*

**4.1 able to describe the appearance of healthy brood;**

A healthy colony should build up strongly to fill at least eight frames, 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. Eggs/larvae of the same age 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 indicate problems. Sealed brood cappings should be even and the colour of digestive biscuits. Perforated, moist or sunken cappings indicate a problem, as would lots of unsealed cells giving a pepper-pot pattern.

**4.2 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 wellies 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 or cloth to reduce robbing

Don'ts

a) Feed foreign honey (i.e. supermarket honey) or honey of unknown source or 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 them to hives in the late evening
d) Buy bees from an unknown source i.e. South/Devon; high risk of Foulbrood and or resistance to varroa treatment

TIPS.

Remove propolis by soaking equipment in washing soda or wiping it with methylated spirit.
Wash bee suits regularly as stings received at previous inspections will provoke bees to sting.

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 hives in different directions; paint them different colours and space them well apart to reduce drifting.

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

**4.3 Aware of the need for regular brood comb replacement**

It is now generally accepted fact changing brood frames (and combs) regularly helps to inhibit brood diseases such as Nosema and EFB. Colonies subject to wholesale frame change often become the most productive in the apiary.

Until recently, the basis of frame replacement most commonly advocated has been one third of the frames every year - i.e. a full replacement every three years. However a 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 be carried out only on strong colonies capable of enduring the stress it creates. Do it as early as possible in the season, and certainly not later than July. Ideally, a good nectar flow should have started, but you will undoubtedly need to feed the bees to help them draw the new comb out.

**4.4 able to describe the signs of the bacterial diseases American Foul Brood (AFB) and European Foul Brood (EFB), the fungal disease Chalk Brood and the viral disease Sac brood;**

**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 in inserted and slowly withdrawn the remains can be drawn out in a brown mucus like thread – this is called the “ropiness” test
- The ropey 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 Sac brood)
- 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 in 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 be 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 may ultimately die.

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 week colonies during early spring
- No treatment available on the market
- In severe cases re-queening from a colony free of chalk brood is recommended

**Sac brood**

**Signs**

- Affects only sealed brood; pupa at 5$^{th}$ moult
- Perforated cappings

- Diseased larvae become yellow-brown fluid filled sacs, then dry to a thin dark brown scale
- The larval sacs have a distinctive gondola shape and are often referred to as 'Chinese Slippers'
- Can be mistaken for AFB but remains will not form rope when probed and are easily removed in one piece form the cell

**Effects upon the colony**

- common viral disease affecting brood only
- rarely causes any measurable harm
- no specific treatment but re-queen severely affected colonies
- combs can be reused as any sac brood virus present on them becomes non-infectious within a few weeks

**4.5 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 that arrived in the UK in 1992. 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.

Perform monitoring in early spring, after the spring honey flow, at the honey harvest and late autumn. If significant invasion takes place then increase monitoring 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<br>*No Action* | Between 2 and 7<br>*Plan Control for coming Season* | Over 7<br>*Consider Control* |
| **April to June** | Less than 1<br>*No Action* | Between 2 and 7<br>*Light Control* | Over 7<br>*Severe Risk* |
| **July and August** | Less than 2<br>*No Action* | Between 2 and 8<br>*Light Control* | Over 8<br>*Severe Risk* |
| **September to December** | Less than 6<br>*No Action* | Between 6 and 8<br>*Light Control* | Over 8<br>*Severe Risk* |

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

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

Using these data, identify actions to reduce the levels of mites back to the "No Action" levels.

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

- It 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 defence will deteriorate, leading to the collapse of the colony.

Additional symptoms:

- Slow build up
- Deformed wing virus

**4.6 aware of acarine (a mite) and Nosema (a microsporidian) 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 that delivers oxygen to the honeybee is comprised of tubes called trachea and air sacs. Acarine mites reproduce and feed in these trachea. 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. Damaged, the trachea 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, 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 infestation levels are low (probably less than 5%) in the UK and acarine is not regarded as 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. Acarine can be seen using a x30 magnifier after dissection of thorax.

**Nosema (a unicellular fungi**)

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 another bee picks up and swallows spores from the excreta, 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 defecate 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. A sample of about 30 bees is required.

Infection of adult bees at a young age can cause the bee to have difficulty digesting food for the rest of its life. These bees usually do not produce brood food/royal jelly secretions from the hypopharyngeal glands and often skip the brood rearing stage of their life, becoming forager bees at a young age. The infected bee often

has a shortened adult lifespan. Infected queens reduced lifespans and cease to lay eggs. The health, population and performance of the colony declines, and it can ultimately die.

A common symptom of Nosema apis infection is dysentery (brown diarrhoea on combs and the outside of the hive). Dysentery is not actually caused by the fungus, although N. apis infections make the infected bee more susceptible to other secondary infections, which subsequently cause the dysentery.

Dysentery around the hive entrance. D. Broberg, www.flickr.com/photos/dbroberg

Infection by N. apis is also associated with the presence of honey bees crawling around the hive entrance, sometimes with wings held at odd angles. Some bees will have swollen and greasy looking abdomens and in severe cases may appear to be trembling.

Unlike *N. apis*, *N. ceranae* is present at similar levels all year round and population losses can occur at any time of the year. Infections typically result in a slow drop in the adult population over summer and heavy winter losses. Sometimes dead bees will be seen around the hive, but this is not always the case. Infection by *N. ceranae* has a similar overall effect on the colony as *N. apis*. However, the dysentery and crawling bee behaviour that is associated with *N. apis*, has not been observed with *N. ceranae*.

Both species of Nosema infect worker bees, queen bees and drones. The fungi produce spores which are ingested by adult honey bees when they feed on food and water contaminated with spores, or are picked up while cleaning contaminated combs, robbing contaminated hives or by infected bees drifting to new hives. A single spore can cause infection, and by the time that infection is fully developed in an adult bee, there could be between 30-50 million spores in the gut of the bee. The life cycle of both Nosema species are similar and consist of the following:

- Infection begins when a bee ingests Nosema spores, which then germinate in its mid-gut
- The fungus enters the cells of the mid-gut and begins to absorb nutrients. The cells become damaged and the bee more susceptible to secondary infections.
- The fungus grows and multiplies, infesting more of the mid-gut cells and produces spores.
- Several million spores can be produced in a single worker. The spores either germinate within the mid-gut, infecting new cells, or pass out through the digestive system.
- Faecal material containing Nosema spores can contaminate food and water sources, and then be ingested by other bees. Spores can also be spread to non-infected bees when they clean contaminated combs, or rob contaminated hives and ingest spores in the process.

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.

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

Integrated Pest Management **(**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 varroacides

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 Programme 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??

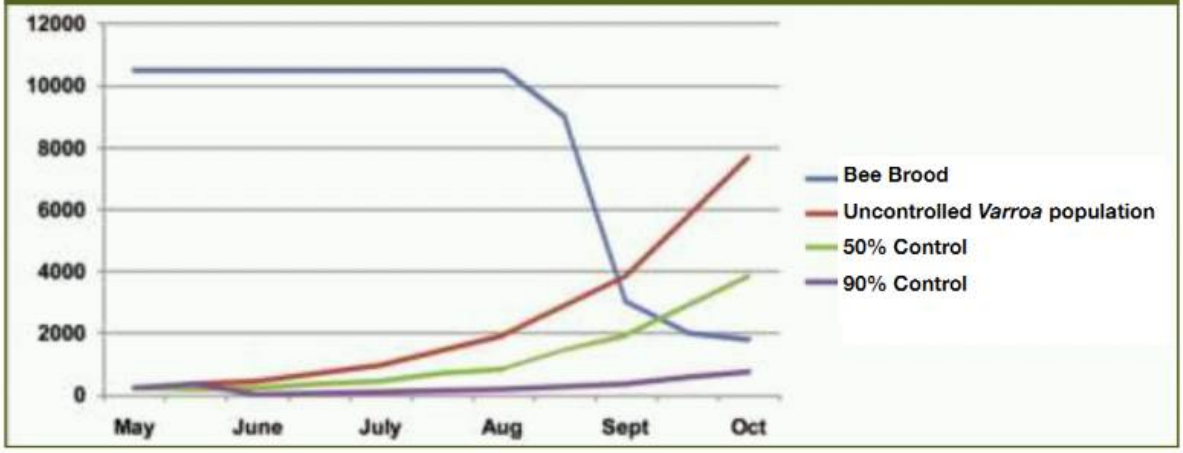
**Good Husbandry**

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. Maintain your apiaries to minimise robbing and drifting. Keep strong vigorous colonies, try to select strains that seem to show Varroa tolerance.

**<u>Slow mite population growth</u>**

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 others, but they do help present infestation reaching damaging levels, treating later. Comb trapping and artificial swarm techniques have 90% efficacy (figure 52). Reducing the use of chemical control, essential where late crops are sought (heather & Himalayan balsam).

Figure 52: The effects of application of biotechnical control methods on *Varroa* populations




**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.

Figure 53: Using mite drop monitoring to decide appropriate level of controls to employ

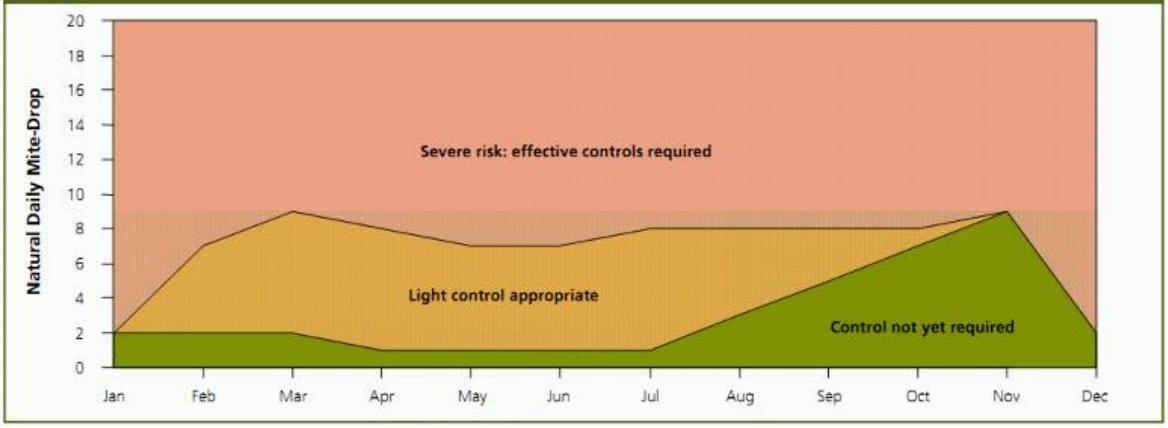


**Table 5: Using drone brood monitoring to decide appropriate level of controls to employ**

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

**Figure 54: Drone brood uncapping, a popular and easy method for routine *Varroa* monitoring. *Varroa* mites are easily seen against the pale drone bodies**

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

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

Since the Act was passed there have been several orders listing notifiable pest and diseases. There are 5:

- American Foul Brood (AFB)
- European Foul Brood (EFB)
- Small Hive Beetle (Aethina tumida)
- Tropilaelaps Mites – any species
- Varroa – this is now officially a notifiable pest. For beekeepers registered on beebase the presence of varroa has already been noted.

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, 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 £5 000)

Varroa is once again classed as notifiable although it is endemic in the bee population no action is required.

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

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

Bees are susceptible to a number of diseases, the two most prevalent being American Foul Brood (AFB) and the European Foul Brood (EFB).

Both AFB and EFB are subject to statutory controls in the UK. The Bees Diseases and Pests Control (England) Order 2006 (SI 2006 No342) empowers the Department for Environment, Food and Rural Affairs (DEFRA) to take measures to control both diseases. In essence this states that any beekeeper who suspects the presence of AFB or EFB must contact 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 the suspected diseased colony should be closed up and a self-imposed standstill should be placed on the apiary, meaning that no bees, comb or equipment should be moved in or out of the site.

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.

The contacts page on beebase will give a listing of the current regional bee inspector and the seasonal bee inspector for Buckinghamshire.

http://www.nationalbeeunit.com/public/Contacts/contacts.cfm

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

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

The larvae of the Greater and Lesser wax moths eat beeswax.

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 bees' faecal matter and old cocoons as part of its diet. The lesser wax moth will also target stored supers.

Never spray combs with any kind of moth killer or insecticide, as beeswax absorbs these chemicals, which will prove fatal to the colony the following season.

Wax moths like warmth and darkness, 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.

Certan 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.

**4.11 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 way 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 Excluders as, although effective at keeping the mice out, they knock too much pollen of the bees' legs, when the value of fresh pollen is at a premium. If you make your own guards the crucial measurement is 10mm.

Put the guards on once you have fed for the bees for winter in September.

In some areas, especially with lots of trees, woodpeckers can be a problem, as the bees inside the wooden hive are like the birds' other insect prey beneath the bark of a tree. It seems that only Green Woodpeckers are the culprits, and then only once one of them discovers your hives as a good source of food; after that those bees that do not become 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.

Put fencing up around the apiary to keep livestock out.

Whatever method you use must be in place before the first frosts.

**4.12 able to describe the procedures for cleaning poly and wooden hives.**

**Wooden hives**

Begin by scraping the boxes as thoroughly as possible with a hive tool, or other suitable tool, to remove any lumps of wax or propolis. Cardboard or newspaper will help to catch the debris. Corners will need special attention as this is where small pests and pathogens like to lurk. Plastic frame runners will need to be removed if you plan to use scorching as your method of sterilisation, but even with metal ones, you may decide to swap these for new ones as they can be tricky to get clean. Once the parts are free from obvious dirt, you will need to pick up and dispose/burn the newspaper/cardboard with the debris on and also clean your hive tool. There are several ways you can clean up and sterilise your wooden hive, but the most popular way is to scorch boxes using a gas torch.

Scorching boxes

Using a blow gas torch simply 'scorch' the boxes, paying particular attention to the inside corners. There is no need to burn the timber, just heat it enough to achieve a coffee-brown colour – this indicates that the wood has reached a high enough temperature for any pathogens to have been killed. Propolis should bubble and boil off.

**Polystyrene Hives**

**Bleach** (Sodium hypochlorite) is used effectively for cleaning polystyrene hives and plastic components such as apidea frames, queen cages, feeders, etc. as well as hive tools. Wax and propolis should be scraped off as much as possible before soaking. Equipment should be soaked in a 0.5% solution (Sodium hypochlorite and water) for at least 20 minutes and then rinsed and aired before use. Any residual wax and propolis will need to be scraped or scrubbed off after immersion. Scrubbing with a washing soda solutions may help to remove any propolois.