The Scottish Beekeepers' Association

Registered Charity No. SCO 09345

BASIC BEEKEEPING CERTIFICATE
Syllabus notes for use by Mentors in preparing candidates for the BB examination. Revised Nov 2016 Sect.3.8
See also revised Syllabus Nov 2016

These notes cover the material in the BB syllabus and follow the syllabus section and paragraph structure. They were prepared by Ian Craig with some notes on the disease section added by Alan Riach. The notes can also be used as a guideline for Beginners' Classes being run by Local Association Tutors.

1.0 MANIPULATION OF THE COLONY

1.1 When handling bees, make all actions deliberate and purposeful. Avoid fast, quick movements; also avoid vibrations and knocks.
Care should be exercised when opening a colony to ensure your own safety, the safety of the general public, pets and other livestock. Try to cause minimum disturbance to the activities of the colony. Bad handling and inclement weather can cause bees to become aggressive.

1.2 Cool, pleasant smoke causes bees to move away and gorge themselves with honey. When their honey sacs are full they are more docile and less liable to sting. Smoke also prevents the transmission of alarm pheromones (chemical messages) within the hive.

1.3 Bee suit, smoker, hive tool, gloves, Wellingtons. Cover cloths.
Cleanliness is important in disease prevention. The odour of previous stings can provoke further aggression at a later date. Never open a hive without wearing a veil.

1.4 Check for the presence of a fertile queen, eggs, sealed brood, stores of honey and pollen. Check for disease, room for expansion, swarm preparations.

1.5 There should be enough stores in the hive to last the bees until your next visit. That might be one week or six months, depending on the time of year.
Stores can be of open or sealed honey and an arc of pollen around the brood or, in autumn, pollen underneath sealed honey.
In the autumn, bees require 15-18kg of sealed stores to see them through the winter. A deep comb of fully sealed stores weighs in the region of 2.5kg, therefore the equivalent of six or seven sealed combs are required prior to wintering. If stores are short, feeding with sugar syrup made by dissolving 1kg white granulated sugar in 550ml of water.
It should be remembered that bees cannot rear brood from honey or sugar syrup alone, they also require pollen.

1.6, 1.7, 1.8, 1.9 Check your hive records so that you know exactly what equipment is required and what you are going to do. Records should also give the history and lineage of the colony.

Approach the colony quietly and place any equipment on the ground close to the hive. Light the smoker and when it is burning satisfactorily give four good puffs of smoke into the hive entrance. Wait for two minutes, then put two more puffs into the entrance and remove the hive roof, placing it upside down behind the hive. Use the hive tool to ease apart hive parts prior to their removal.

Smoke between hive parts before their removal, placing them diagonally on the upturned roof. It is essential that supers are placed on the roof behind the hive so that if a queen should take flight she will not return to the front area of the hive and land in a super. Take care that the queen is not on the underside of the crown board or queen excluder.

Gently smoke the bees from the top and lugs of the frame about to be removed. Use the hive tool to ease the frames apart and lift them out individually for inspection.

Remove the dummy board or an end frame and prop in front of hive to provide space for freeing and removing further frames.

No jerky or fast movements are acceptable.

Keep the bees under control both at the entrance and at the frame tops.

In order to avoid crushing bees when replacing hive parts, smoke the parts above and below.

The hive tool should be held permanently in your right hand and the smoker hung on the edge of the hive, ready for instant use. Should your smoker run out of fuel, stop and re-fuel.

1.10 Identify worker cells (5 to the inch), drone cells (4 to the inch), queen cells (acorn shaped) and queen cups (cup shaped start of queen cells).

Are the combs old/new/blackened with age/over abundance of drone combs/combs irregular/full of holes/pollen clogged?

1.11 Identify queen, workers and drones.

1.12 Identify eggs, larvae, sealed brood and hatching brood. Appearance of healthy brood.

1.13 Identify worker, drone and honey cappings.

1.14 Identify stored unripe honey, honey and pollen.

1.15 The usual reason for taking a sample of bees is to check for the presence of Acarine disease and Nosema disease. These diseases are more prevalent in older bees. Older bees are to be found mainly on the outside combs in the brood chamber. Collect a sample of approximately 30 bees by drawing a partially open matchbox up the face of the second comb from the edge of the brood chamber or collected at the entrance

Be careful not to collect the queen.

1.16 Thirty bees are the minimum number needed to provide a statistically meaningful sample

1.17 Demonstrate the method of shaking bees from a comb in order to inspect it for one of the foul brood diseases, for queen cells or to renew the comb.

2.0. EQUIPMENT

2.1 **Hives:**-National, Modified National, Modified Commercial, WBC; all bottom bee space.
Smith, Langstroth, Dadant; all top bee space.
Hive Parts:-Floorboard, entrance block, brood chamber(s), queen excluder, super(s), crown (or cover) board, roof. Dummy board(s) in some hives.

2.2 Langstroth discovered the significance of the 'bee space', the space for a bee to move.
The size of the bee space is 8mm. If it is less than 6mm the bees will propolise it and if it is greater than 9mm they will build brace comb in it, thus making it extremely difficult to remove frames for inspection.

2.3 Frame assembly. Top bar, side bars, bottom bars. Use frame nails.(19mm enamelled gimp pins). Pins should be inserted horizontally through the side bars into the top bar.
Wax foundation - can be wired or unwired depending on its purpose. Some frames are now made from plastic.
Frames in the brood chamber are usually deeper than those in the supers.

2.4 Wax foundation induces the bees to build (draw) straight comb in the frame.
The bees can be induced to build either worker or drone comb depending on how the foundation is embossed. Old combs can be removed from the frame and replaced with new foundation. Foundation can be wired or unwired.
All super foundation should be wired unless honey for eating in the comb is being produced. Thin, unwired foundation should be specified for cut-comb. Some foundation can be of wax-coated plastic.

2.5 Metal ends (36.5mm and 48mm), plastic ends (36.5mm and 50mm), Hoffman self-spacing frames (35mm), castellated spacers (10 castellations give 41mm spacing, 9 give 48mm).
Use castellated spacers with drawn comb in the supers only as they do not allow the frames to be separated before withdrawing in the deep and could lead to queen damage.
Spacing in the brood chamber should be 35-36.5mm. Spacing in a super of foundation should be 35-41mm and in a super of drawn comb it can be 48-50mm.
Manley self-spacing frames are fixed at 41mm. They should be used only in supers for extracted or comb honey.

3.0 PRACTICE OF BEEKEEPING

3.1 It is important to choose an apiary site with care because bees can only be moved less than three feet or more than three miles or they will be unable to locate their hive.
The requirements for an apiary are:-
Adequate forage – nectar, pollen, water.
Minimal danger to humans and animals. Away from public thoroughfare.

Facing the early morning sun. Not in a frost pocket. Wind protection.
Free from drips from trees and vibrations, eg. sawmill.
Free from flooding.
Accessible from a road. Hidden from vandals. Stock-proof fence.
The hives in the apiary should be randomly spaced to minimise drifting, with plenty of room for manipulation. The beekeeper should not stand in the bees' flight line.

3.2 Nuisance can be stinging neighbours and animals, swarming, and soiling washing and cars.
The apiary should be carefully selected according to the principles set out in 3.1. Ensure that the bees' flight paths do not interfere with neighbours, the public or animals. If this proves difficult, cultivate a high hedge or small-mesh netting to force the bees to fly higher, out of harm's way. Maintain good tempered bees. Ensure that fences etc. are animal and, if possible, childproof.
Out apiaries are the better option. If you must have bees in the garden in close proximity to neighbours, limit the number of stocks to two or three.

3.3 The queen, drones and worker bees less than fourteen days old cannot sting.
Stings can be minimised by maintaining docile bees, handling bees correctly, opening stocks in favourable weather conditions, wearing protective clothing (avoid woollen or corduroy garments or garments dyed blue), dispersing the sting pheromone by use of smoke, refraining from using perfumes and aftershave.
The effects of stings can vary according to the individual. To most beekeepers a sting causes pain, a reddening of the skin and swelling. After a few years a natural immunity builds up and effects will be minimal.
Extensive swelling or irritating rash may occur taking twelve hours to reach its maximum and two or three days to subside. This may indicate a sensitivity to bee venom.
A generalised reaction with symptoms of difficulty in breathing, skin rash, palpitations, vomiting and faintness occurring within minutes of a single sting indicates severe reaction (anaphylaxis) requiring emergency medical attention. A person experiencing such symptoms should not become a beekeeper.
First aid treatment:-Immediately scrape out the sting with fingernail or hive tool. Squeezing the sting injects more venom into the body. Away from the bees, try applying ice to the site of the sting. The application of calamine lotion or steroid creams may give some relief. Avoid antihistamine creams. Aspirin tablets may reduce pain and inflammation. Piriton tablets contain antihistamine and may lessen symptoms but could cause drowsiness. Discuss these suggestions with your doctor.

3.4 YEAR'S WORK IN THE APIARY
JANUARY
Undisturbed but check: security, after gales, animal disturbance, fences.
Clear entrances of debris. Don't clear snow; it is porous and keeps the bees from being enticed out in bright conditions.
Entrance blocks still secure. Type with holes may remove pollen from baskets.
Food: Heft -apply Fondant or wetted Sugar Bags.

Consider dummies, insulation. Matches under corners of crown boards provide through ventilation.
Slabs provide a firm base for stands. Slabs/stands should tilt hive forward slightly.
Beginners/others purchase equipment.
Prepare hive record book.

FEBRUARY
Check: security, signs of activity, signs at the hive entrance, feel for heat on surface of crown board.
Remove matches from corners of crown boards if fitted. Open mesh floors – tray inserted to reduce draughts as brood rearing will have started.
Apply bee-safe preservative to exterior surfaces of hive - not paint.
Assemble hives. Carry out repairs.
Assemble frames.

MARCH
Signs of brood rearing Heat on top of crown board Activity Pollen required for brood rearing.
Clean floorboard.
Single small brood chamber hives (National, Smith & WBC), may be short of food.
Feeders and feeding. Use contact feeders (it is too cold in spring for bees to climb over weir of rapid feeders) or insulated rapid feeders.
Consider spring stimulation? Uniting?
Inferior combs removed.
Fumigation of spare equipment with 80% Glacial Acetic Acid or 85% Formic Acid.
Apiary sites - Consider how many other apiaries are likely to be in the area but consider limiting numbers to 7 to 10 colonies per apiary.

APRIL
Nectar & pollen sources- flowering currant, dandelion, willow, cherry, gorse, blackthorn, top fruit.
Old pollen pellets (layers).
Chalk Brood mummies- sign of stress -feed, requeen, sprinkle frame tops with salt to encourage hygienic behaviour.
Monitor for Varroa - Vary treatments, See Beebase "Managing Varroa"
Best colonies have drones first. Insert frame of drone foundation?
Value of early drones. Bees work better with drones present - 13 days to reach fertility
First inspection.-If cold use manipulating board/cloths.
Clip/mark queen. Check for eggs & sealed brood. Check for failing/inferior queen.
Check for AFB, EFB, inbreeding
Food supply.
Remove 2 inferior combs.
Do not reverse brood chambers if on doubles.
Check room for expansion.
Add Queen excluder & first super of drawn comb, if available.
When do bees need to draw foundation? – In a flow.

Flow can be simulated by feeding 1:1 syrup (1 ltr to 1 kg)

MAY
OSR, sycamore, horse chestnut, bluebell, hawthorn, top fruit
Value of strong colonies.
Check for swarm preparations.
Check laying space & room for expansion.
Reading a colony – activity at entrance; even, expanding brood area; bees active & busy.
Add 2 frames + foundation.
Week after start of honey flow add 2nd super (If of foundation, add below 1st super to get warmth of brood nest to aid drawing out).
Check for queen cells.
Check for plenty of super room for bees to hang nectar out to dry.
Queen cells found. Do not cut out before analysing colony condition.
Artificial swarm technique. Check bottom brood chamber (BC) after 10 days.

JUNE
Remove spring honey if ripe. Check with Refractometer
June gap - be prepared to feed – discuss emergency sugar bags and fondant.
Check Varroa mite fall or uncap drone brood.
Check for queen cells at end of spring flow.
Keep first batch of cells - the Q's from these will be 10% heavier, 8% more spermatheca capacity, 3% more ovarioles.
If colony is on a double BC about 20th June, reduce to a single (11 BS frames). In 2/3 weeks release trapped drones from top BC by inserting an 8mm piece of wood under the top BC.
Induced queen rearing. Feed BC where queens are being reared until the QC's are sealed.
Check 3 days after art. swarm was made and remove sealed Q cells because they will have been made from old larvae & will not have received their full measure of royal jelly.
Take care when handling frames containing queen cells – Q is suspended on royal jelly by surface tension & can be jolted off. Handle these frames upside-down.
Within 1 or 2 days from hatching distribute QC's.
Young queen might not lay in a large hive until old Q's brood has hatched.

JULY
Clover, bramble, bell heather, lime, willow herb
Check if any colonies are still drawing QC's
Assess new queen before introduction. Do not mark or clip until next spring.
Check for: in-breeding, drone breeder (not mated 3-4wk), laying workers.
In a good year excellent comb can be drawn in large nuclei with early Q.
Cut combManley frames (41mm)compared to narrow spacing (35-36.5mm).
Worker or drone foundation. Starter strips for cut comb as central rib will be thinner.
If cut comb required at heather get foundation drawn before moving hives.
Sections - no Queen excluder; give one super at a time (or bees may Sulk). Hanging section holders (3 square sections in a special holding frame).

AUGUST
Summer honey flow still in progress. Watch super room (Not too much to prevent them spreading honey around).
Assessing the honey quality.
Heather v. Balsam.
If not going to heather, remove honey, winter quarters, requeen if required.
Ensure plenty of room for bees, room for breeding, & especially room for winter stores.
Temporary rear top entrance when uniting within the same apiary.
Extraction and straining
Varroa treatment. Methods. Discuss winter bees
Feeding. Problem with Apiguard – some colonies won't take food; sufficient ambient temperature to evaporate the gel (Put insulation above the crownboard).
Going to heatherSingle BC. Boost numbers until bees are boiling over.
Young queen. Eggs/open brood on flanks.
Insulation on top.

SEPTEMBER
Feed 1kg to 550ml + thymol (0.5ml of stock solution /litre syrup – Stock soln. 50gm thymol crystals/250ml of surgical spirit). Feed inevening. All colonies in apiary same time.
Reduce entrances.
Miller or Ashforth rapid feeders.
Storage of combswet or dry? Wax moths. Certan.
Cut comb and sections prepared for market.
Clean extraction equipment and store in a dry place. (Wash in cold water first)
Boil Porter escapes in washing soda.

OCTOBER
Nectar and pollen from ivy.
Mouse guards.
Varroa control removed.
Drones expelled.
Deal with wax cappings. Burn old brood comb to get rid of diluted varroacides and disease spores.
Deal with honey for the market.

NOVEMBER
No disturbance.
Match sticks under crown board for extra ventilation if in damp area.
Open mesh floors.
Insulation above crownboard.
Study hive records.
Selection of possible breeding stock for next season.

DECEMBER
Check if apiary is in a frost pocket.

Check hives for damage - mice, woodpecker.
Varroa treatment (refer to "Managing Varroa" PDF on Beebase)
Clean the queen excluder in frosty weather.
Make a list of equipment required for next season.
All equipment should be compatible.

3.5 Spring feeding and all liquid feeding except Autumn feeding:-

Dissolve 1kg white granulated sugar in 1litre of, preferably, warm water.
Feed in a contact feeder.

Autumn feeding:-

Dissolve 1kg white granulated sugar in 550ml hot water.
Some beekeepers add a quantity of **thymol** about half the size of a grain of barley to 7kg sugar before the water is added. This helps to combat Nosema and avoids the syrup fermenting in the storage combs if the bees have not had time to seal it properly.
Feed can also be purchased ready made from equipment suppliers.
Feed in a Miller or Ashforth feeder for rapid feeding. A contact feeder is slower but quite suitable.

Winter feeding:-

Liquid feed should not be applied when the bees are unable to take cleansing flights.
Feed proprietary bee fondant, baker's fondant, homemade candy or damp sugar bags.
At any time never use brown sugar or icing sugar only white granulated sugar.
A spare comb of honey can be fed at any time. Never feed honey of unknown origin to bees. Honey purchased from shops, especially foreign honey, may contain spores of foul brood disease.

When to feed:-

Bees must be fed in any season if they are short of food.
Feed all stocks in the same apiary at the same time. Reduce entrances to avoid robbing by wasps and bees from other hives. Feed in the evening as bees are not equipped for flying in the dark. Do not spill syrup as it may induce robbing. Do not feed nuclei sited in the apiary from which they came, for forty eight hours, until all the old field bees return to their original hive.

3.6 Supers provide extra space for bees to occupy, provide space for the storage of honey and for spreading out nectar to ripen.
In spring supers should be added, above a queen excluder, in good time in order to avoid congestion in the hive with a consequent reduction in the circulation of pheromones and the danger of inducing swarming. The first super should be added when the bees start to occupy the outside combs in the brood chamber. This should be done even if there is no honey flow. Give a super for the bees to occupy.
In order to encourage the bees to occupy the first super quickly it should, if possible, consist of drawn comb and a wire queen excluder should be used. The second super may be of foundation. If so, it should be placed under the first so that the foundation can be drawn next to the warmth of the brood chamber.

In late summer when the danger of swarming is over, unoccupied supers should be removed. Partially completed supers can be put on to strong hives in an attempt to try to get the honey in them ripened and sealed prior to extraction.

3.7 When queen cells are found in a colony they are an indication that the bees are intending to swarm. It is a waste of time cutting them out as they will probably appear again the following week. The simplest method of swarm control is the artificial swarm. It is also the method which comes closest to satisfying the natural instincts of the bees. An artificial swarm may be created whether or not queen cells are present. For this operation virtually a second hive is required. Proceed as follows:-
find the queen and place her, on the comb with bees on which she is found, in the centre of a new brood box making sure that any queen cells on this comb are completely removed. Add a second comb of sealed brood and bees, free of queen cells. Fill out the box with drawn comb if it is available, if not, use foundation. Place this new brood chamber on the original site, add the queen excluder, supers, crownboard and roof. Usually there will be plenty of food in the super, but check. This is the artificial swarm.
Place the original brood chamber on a new floorboard plus entrance block on a new site about a metre to one side. Add a crownboard, feeder and roof. The field bees in this original brood chamber will return to the original site and rejoin the queen in the artificial swarm; hence the need for a feeder. The entrance must be restricted otherwise the now weakened colony will possibly be robbed out. Don't feed for forty-eight hours. The supers remain with the artificial swarm on the original site because that is where the field bees are.
Before the queen cells in the original colony are due to hatch they can be reduced to one in case the first virgin to hatch flies off with a cast. Another alternative is to transfer the colony to the other side of the original site a few days after artificially swarming but before the first virgin has emerged. This causes the new field bees from the original brood chamber to rejoin the queen in the artificial swarm, thus making it into a powerful honey-gathering force. The original colony is now just a big nucleus and it is no longer necessary to remove surplus queen cells unless they are required to re-queen another colony or to make another nucleus.
The above description is of the Pagden Method of swarm control.
A considerable saving in equipment and space can be made if, instead of placing the original brood box on a new site, it is placed on a separation board with special entrances above the supers on the original site. This board is often referred to as a Swarm Board or Modified Snelgrove Board.

3.8 Production of a new queen – New queens can be produced as a consequence of either of the most common swarm control methods –Pagden, Demaree or Snelgrove. Precautions should be taken to ensure that the new queen is produced from an egg or from a very young larva (one day old) to ensure that the larva has received a full charge of royal jelly. The best queen cells will be those that the bees have produced in preparation for swarming as these will have been very well fed.

3.9 If the queen is removed from a colony, within ten to fifteen minutes signs of

queenlessness will be observed at the hive entrance. Bees will be seen wandering about at the hive entrance and on the sides of the hive looking for her. Foraging will be greatly reduced and the colony will become more aggressive.
Inside the hive, there will be no eggs and eventually no brood and fewer bees.
Queen-less Test – Insert a frame of eggs and young brood – if queen-less the bees will draw queen cells.

3.10 If a virgin queen fails to hatch or fails to mate or fails to return from her mating flight and the colony has been queenless for at least three weeks and has no hope of raising a queen, the ovaries of a few workers develop to such an extent that they are capable of laying some eggs. These eggs will be unfertilised and will only produce small stunted drones.
The presence of laying workers can be detected by haphazard laying pattern, drone cappings on worker cells, more than one egg laid per cell, eggs attached to the wall of the cell not on the bottom. The colony endeavours to produce queen cells.
A colony which has laying workers is not worth saving because the bees are all old. The best course of action is to shake the bees on to the grass at least 100m from the hive site, remove the hive and let the bees gain access to another hive if they can. This should not be attempted if disease is suspected.
If a queen has run out of sperm due to inadequate mating or old age and becomes a drone layer she can still be seen in the hive. She may be capable of laying a normal pattern of eggs, but domed cell cappings indicate that she is a drone layer. Small, stunted drones will appear in the colony.
It is worth mentioning that a young queen, just starting to lay, sometimes lays more than one egg in a cell, but the eggs are in the cell bottom. She should lay normally within a short time.

3.11 Use of a Butler Cage. Can also use plastic "puzzle" cages. If introducing a purchased queen, remove accompanying workers to reduce risk of fighting.

3.12 Robbing can occur if food is scarce especially at the end of a honey flow. Bees from one or more hives can attack another hive in the apiary. Wasps and ants can also be robbers. Robbing can be for honey or sugar syrup.
Robbing can be prevented by not having hives open too long at the end of the season, maintaining strong colonies, restricting hive entrances, taking care not to spill sugar syrup, maintaining bee-tight hives (especially check roof ledges), not leaving cleared supers exposed.
Once robbing has started it is difficult to stop. Reduce all entrances (nuclei to one bee-space), heap grass at hive entrance, lean a piece of glass over the hive entrance so that the owner bees have to enter from the sides.

3.13 The most common and trouble free method of uniting two colonies is by using a sheet of newspaper between the two chambers to be united. A few pinpricks in the paper will give the bees a start. They eat through the newspaper and unite slowly allowing the two hive odours to gradually intermingle and the bees unite peaceably. They should be left undisturbed for a week to settle down. It is safer to remove the

unwanted queen prior to uniting. Uniting is best performed just as it is getting dark because the flying bees from the top unit, which is going to be 'imprisoned', will mostly have returned home.

3.14 Two units may require to be united for a number of reasons - requeening where the queen in one brood chamber is removed and the brood chamber with the queen to be kept is placed above a sheet of newspaper; uniting two or more smaller colonies in spring provided both are disease free. (It is well known that a strong colony will collect more honey than two separate weak ones); to reduce the number of colonies at the end of the season prior to feeding in preparation for winter.

3.15 Prior to moving, surplus honey can be removed in order to lighten the weight of the hive. Take care to leave enough food for the journey and for the following week at least, especially if it is going to the heather. Prepare the colony during the day, check if it is queenright and give it at least one super if there is a honey flow.
To avoid the hive overheating on the journey it should have either an open-mesh floor or a top ventilation screen. It should be secured firmly with a hive strap.
The hive can be moved when the bees are not flying, that is in very early morning or late evening. The entrance should be blocked with a piece of foam rubber. When placing the hive(s) in a vehicle the frames should run fore and aft to reduce movement when accelerating or braking.

3.16 The main risk is if the hive strap is insecure or the boxes are not bee-tight thus allowing bees to escape into the vehicle. When transporting hives on a trailer or lorry, they must be securely tied down in case they should overturn when cornering. Note that most insurance policies (including the SBA's insurer), do not provide cover for bees in transit.

3.17 The simplest method of clearing bees from supers is to deploy two Porter bee escapes pressed into the slots in the crownboard. Supers are usually cleared of bees in forty eight hours. It must be understood that the supers must be bee-tight, otherwise they will be robbed out when there are no bees inside to defend them.
Two Porter escapes should be deployed in case one should become blocked by a drone which had earlier found its way into the supers. Never leave Porter escapes in the crownboard when they are not in use as the bees will propolise the springs thus rendering them ineffective later. The escapes can be cleaned at the end of the season by boiling them in water containing washing soda.
Another method of clearing bees from supers is to use a Canadian clearer board. These are fast and effective but if left too long the bees will eventually find their way back into the supers.
Supers of honey should be removed in the evening because bees cannot navigate in the dark. Never leave supers exposed when bees are flying, because robbing will be instigated.
If only a few frames of honey are to be removed, the bees can simply be shaken or brushed from the combs.

3.18 When honey is sealed it is ripe and ready for extraction. If it is unsealed but has been in the super for some time its moisture content might be under 20% and it will keep for a period, but not as long as it would if the moisture content had been lower. Moisture content can be checked using a refractometer, but if you do not possess one, hold the frame of partially sealed honey over the super and give it two hearty shakes. If no thin honey spills out, it is safe to extract.

Equipment for handling honey must be made of stainless steel or food grade plastic.

The comb to be uncapped is supported at a slight angle above a receptacle to catch the cappings and drips of honey. Uncapping knives can have a serrated blade and be used cold or have a plain blade and be used hot.

There are two types of honey extractor, radial or tangential. The extracted honey collects in the bottom of the extractor and can be tapped off into a honey pail for transfer into a mesh strainer fixed above a 200micron cloth or bag, a very fine mesh strainer (less than 300micron) and collected in another honey pail, lidded and stored at or below 13degC to be jarred later.

The honey in the pail may or may not granulate (set). It may set smooth and soft or coarse and hard or be half set and half liquid. In order to produce a nicely presented honey, heat will be required. Heating should be carried out in a thermostatically controlled hot air cabinet or, for more rapid heating, in a thermostatically controlled water boiler. Honey must never be subjected to direct heat. Do not overheat honey or its HMF will go beyond the legal limit of 40mg/kg.

There are two main types of honey sold in the jar, clear (runny) honey and soft set (not spoon-bending) honey.

To produce clear honey, proceed as follows:-Completely re-melt the set honey at 50degC for up to 48hr depending on its condition, re-strain into a bottling tank and allow to cool to 32degC, then run into heated thoroughly clean jars. If you are supplying shops and wish to have the honey remain clear for up to 6 months, make sure that the lids are tight on the jars, immerse the jars in a water bath at a temperature of 60degC for three quarters of an hour, then cool rapidly outside and store at 13degC.

To produce soft set honey:-

(i) If the honey in the stored pail has set naturally with a soft texture and fine grain, heat at 32degC until it can be stirred, then pour into warm jars, leave the jars in a warm room overnight to allow any trapped air-bubbles to rise and store at 13degC.

(ii) If it has set with a hard texture and coarse grain, or not set at all, heat at 50degC until it has completely re-melted, cool to 32degC. At the same time take a quantity of finely grained set honey (termed ‘seed’ honey) which you have kept from a previous year and soften it at 32degC (but <u>not</u> melted), until it can be stirred. Mix 10% seed honey with your melted honey and stir, taking care not to stir air into the mixture.

Leave in a warm room overnight to allow any trapped air bubbles to rise, jar and store at 13degC. Honey treated in this way should reset with a soft texture and be free of shrinkage from the side of the jar and free from ‘frosting’ (This frosting is

anhydrous dextrose giving a white cauliflower-like appearance at the sides of the jar, thus spoiling its sales appeal).
After it has set, store at 10degC.

3.19 Honey is a food, therefore good hygiene should be practised when handling.
Extraction premises:-
Kitchen allowable if used for no more than 5 days in any 5 consecutive weeks.
Washable surfaces.
Windows & doors insect & vermin proof.
2 Sinks for utensils & hands.
Separate toilet facilities. Wash hands.
Equipment stainless steel or food grade plastic.
High standard of general hygiene. Overalls, hat, hands, nails. No cuts.
No smoking, no cats, no dogs.
Laundering & other activities should be discontinued whilst premises are being used for honey processing.
Good storage of un-extracted supers and bulk honey.

3.20 Honey containers should be made from materials which do not transfer their constituent materials to the honey in quantities which could endanger human health or cause deterioration of the honey. To ensure that a jar contains the stated quantity of honey, there should be no air-space between the bottom rim of the lid and the surface of the honey.
The labelling regulations for honey containers stipulate that labels must state :-

(i) The word 'HONEY' which may be prefixed with the type of honey and/or area of origin. eg. Renfrewshire Heather Honey. If specifying plant origin at least 80% should be from that plant.
(ii) The metric weight. The figures to be at least 4mm high for 227g, 340g and 454g weights. If imperial units are also shown they must be in close proximity to the metric and be less prominent.
(iii) The name and address of the producer, packer or seller.
(iv) The country of origin. eg. Product of the UK.
(v) The 'best before' date. If day, month and year is given there is no need for a lot number.

3.21 Wax scrapings and brace comb can be collected during the year and stored in sealed containers to be rendered later. Wax can be reclaimed from old brood combs but, preferably should be burned because it will probably contain diluted Varroa treatment chemicals and possibly disease spores. The best quality, relatively clean, wax is derived from cappings.
When comb is being uncapped, as described in 3.18, the cappings should be made to fall on to a perforated metal coarse strainer. The honey trapped in the cappings will strain through into a suitable receptacle. This honey will be of good quality because it will have been sealed.
If you have a small quantity of cappings, they can be placed in a Miller feeder with the centre baffle removed and given to a colony to remove the adhering honey.

For larger quantities, the cappings can be put into a honey bucket which is then filled with water and allowed to soak for 24hr. The honey-water is then drained off for disposal or for making mead. The cappings are given a further 24hr soaking and allowed to drain to semi-dry.
The semi-dry/dry cappings are then melted in a steam, or solar, wax extractor and run into a suitable container, the inside of which has been wiped with 1% 'Fairy Liquid' to act as a release agent. On the following day the top and bottom surface of the cake of wax should be scraped free of propolis, dirt and dross.
The cake should then be re-melted and strained through a jelly bag or lint or old stocking, taking care not to heat the wax above 65degC to prevent discolouration. The melting point of beeswax is approx. 65degC and the setting point is approx. 63degC. The oftener wax is heated the darker it becomes. Like honey, wax must never be subjected to direct heat.
If it is intended that the wax is to be used for making foundation, some books recommend that during the initial melting the wax should be maintained at a temperature of 100degC for a minimum of 30min in order to kill off Foul Brood pathogens.

3.22 Always keep the apiary clean and tidy.
Never throw brace comb on the ground. Keep a container for scrapings etc.
Never purchase old combs.
Do not purchase bees unless you are sure that they have come from apiaries which are disease free.
Disinfect second hand hives and equipment before use.
Never feed honey or allow bees to gain access to it. Honey from unknown sources can carry spores of foul brood.
If a colony dies out during winter, close up the hive and try to establish the cause of its demise. Fumigate the hive with 80% Glacial Acetic Acid or 85% Formic Acid administered on absorbent pads before restocking the hive.
Do not exchange frames between colonies unless you are sure that they are free from disease.
Take care to prevent robbing. Do not spill syrup or use leaky feeders.
Arrange hives in such a way that drifting is minimized.
Clean tools with Washing Soda crystals (Sodium Carbonate) made up at 200g/litre

3.23 Combs should be replaced on a regular basis to reduce the chances of harbouring diseases and to avoid a build up of chemicals used for Varroa treatments which can build up in the wax.
Replace combs which contain old hard pollen, are deformed, have holes or sections missing or have too much drone comb. Such combs reduce the comb area available for rearing worker bees.

3.24 There are numerous methods of capturing a swarm, depending on where it has landed. It should be captured in a box by shaking it in, brushing it in, smoking it up from below, enticing it with a chemical lure, using a frame of brood, etc. It can be hived by shaking it into a brood chamber containing frames with wired foundation.

Feed three litres of 1:1 syrup. Nothing will draw foundation better or faster than a natural swarm.
Swarms are usually good tempered during the first few hours because their honey sacs are full. They can be bad tempered if they have hung out overnight in the rain becoming hungry.
A second or third swarm from the same colony is known as a cast.

Notes
Colonies should be maintained as strong as possible from May until August because a honey flow can arrive at any time depending on the weather. It is pointless having bees build up on the flow, they should be ready to take full advantage of it whenever it comes. There are three main considerations:-
(i) You may have to resort to spring stimulative feeding on order to encourage an early build-up of foragers for crops such as oilseed rape.
(ii) Try to have swarming or artificial swarming past by late June and the bees settled in time to take full advantage of the main honey flow in July and August.
(iii) The queens in colonies which have been working hard gathering summer honey usually cut back their egg-laying in the latter half of July because a large force of field bees will not be required in autumn. If such colonies are to be taken to a late flow such as ling heather, the old queen should be removed and numbers boosted by uniting a strong nucleus with a young queen and young bees. The brood chamber should be rearranged so that eggs and young brood are in the flanks where it will take two weeks to hatch. If hatching brood is in the flanks, when it hatches the bees will fill the cells with honey before the queen can lay in them causing restriction in her egg laying and less honey in the supers.

4.0 NATURAL HISTORY OF THE HONEYBEE

4.1 The size of a colony of honeybees varies throughout the year. It starts off in early spring with a few thousand worker bees and a queen and it reaches a peak of forty to fifty thousand workers, one queen and three or four hundred drones by mid summer.
Workers are produced from fertilised eggs having thirty two chromosomes and are produced in hexagonal worker cells which are five to the inch. When the egg hatches, after three days, the larva is progressively fed with brood food, pollen and honey until the cell is sealed on the ninth day. It then turns into a pupa and finally into an adult worker bee. Workers are undeveloped females.
Queens are produced from fertilised eggs having thirty two chromosomes and are produced in large acorn-shaped cells which are liberally supplied with royal jelly only. The queen is capable of laying both fertilised and unfertilised eggs.
Drones are produced from unfertilised eggs having only sixteen chromosomes. They are produced in hexagonal drone cells which are four to the inch.

4.2	WORKER	QUEEN	DRONE
OPEN CELL			
Egg	3 days	3d	3d
Larva	5d	5d	7d
SEALED CELL			
Larva	3d	2d	4d
Pupa	10d	6d	10d
HATCHES AFTER	21d	16d	24d
ADULT LIFESPAN			
Summer bee	6 weeks	3 years	4 months
Winter bee	6 months	3 years	nil

EGG TO ADULT WORKER:

1st day	egg vertical; stuck to cell bottom.
2nd day	egg at 45deg.
3rd day	egg horizontal; hatches.
4th – 8th day	larva feeding; four moults; cell sealed after last meal.
9th – 21st day	Metamorphosis occurs and the larva changes to a pupa after 5th moult three days after sealing. Adult emerges on 21st day. The 6th moult occurs prior to emergence.

4.3 WORKER

1st – 3rd day	Cell cleaning and brood incubation.
4th – 6th day	Feeding older larvae with brood food + honey + pollen.
7th – 12th day	Feeding younger larvae with brood food only
13th – 18th day	Processing nectar into honey, wax making, water evaporation, packing pollen, storing and capping honey and pollen.
19th – 21st day	Guarding and starting to forage.
3rd – 6th week	Foraging for nectar, pollen, water and propolis.

The stated times are approximate. Older bees can revert to their earlier duties depending on the requirements of the colony, especially in springtime. Other duties include hive ventilation, humidity and temperature control.
After six days the bees' hypopharyngeal glands are capable of producing brood food (Royal jelly). The consumption of honey stimulates the wax glands. The last gland to develop is the sting gland, this occurs when guard duties begin.
During the third week orientation flights occur prior to the start of foraging.

DRONE

Up to day 12	Mostly confined to the hive except for cleansing and orientation flights.
12th – 14th day	Mature and ready to mate.

QUEEN

1st day	Seeking and killing rivals.

3^{rd} – 5^{th} day Orientation flights.
1^{st} – 3^{rd} week Multiple mating flights.

The queen can start to lay about four days after last mating but sometimes does not do so until the last of the previous queen's brood has hatched. If the queen has not mated within twenty days, because of bad weather, she usually becomes a drone layer.

4.4 Wax is produced from four pairs of glands on the underside of the abdomen of worker bees 12 to 18 days old. Wax is secreted at a temperature of 33-36degC appearing as a liquid which oxidises into a flake of wax. Five to eight kilograms of honey is required to be consumed to make one kilogram of wax.
In order to build comb, workers gorge themselves with honey and hang in festoons for about 24 hours before wax is secreted and the comb building process starts.
Queenlessness inhibits the production of wax.

4.5 Pollination is the transfer of pollen from the anthers of a flower to the stigma of that flower or another flower on the same plant or another plant of the same species.
Nectar is secreted by plants to attract pollinators. Bees provide for cross-pollination of plants thereby ensuring a greater variety in the offspring than by self pollination.
Fertilisation is the union of the male and female gametes which occurs after pollination.
Many crops in Britain flower in spring and produce their harvest in autumn.
The honey bee is the only pollinator which over-winters as a colony and which is available in large numbers early in the season before other pollinators are up to strength.
Bees can be transported to crops such as fruit for pollination; they also tend to be constant to one plant species at a time. Crops such as oilseed rape (Canola) are wind pollinated, but it has been shown that bees provide a better seed set and consequently a better yield.

4.6 Most plants produce both nectar and pollen.
<u>Early Spring</u>
Snowdrop, crocus, gorse, goat willow, yew. (all pollen only)

<u>Spring</u>
Sloe, dandelion, flowering currant (nectar only), rape, top fruit, bluebell sycamore, horse chestnut, hawthorn, holly, rowan, laurel

.

<u>Summer</u>
Poppy (pollen only), thistle, hogweed, field bean, raspberry, white clover, charlock, runner bean, lime, bramble, willow herb, bell heather.

<u>Early Autumn</u>
Evening primrose (pollen only), ling, Himalayan balsam.

Late Autumn
Ivy, Michaelmas daisy (pollen only).
The plants in a candidate's home area should be known. In some areas, for example, wild thyme or sea lavender may yield nectar.

4.7 Nectar is the sugary substance secreted in the nectaries of plants. It consists mainly of sucrose, glucose and fructose, water and small amounts of other substances such as salts, acids, enzymes, proteins and aromatic substances.
Honey made from nectar with a high glucose content granulates quickly with a fine grain.
Honey made from nectar with a high fructose content granulates slowly with a coarse grain.
Bees will take whatever is available but they prefer balanced nectars with a high overall sugar content.
Scout bees are sent out from the hive to locate sources of nectar. They return to the hive with a sample load and communicate the source by performing a round or figure-of-eight wag-tail dance. The source selected is likely to be that consisting of the highest sugar content and closest to the hive. Nectar is sucked up through the bees proboscis and stored in it's honey sac. The enzyme invertase from the bee's hypopharyngeal glands is added to the nectar en route to the honey sac and the conversion of sucrose (disaccharide) to fructose and glucose (monosaccharides) starts during the flight back to the hive. This process is continued by the house bee receiving the load from the returning forager.
Nectar is used for immediate consumption by the bees and converted into honey for storing.

Conversion of nectar into honey involves two changes:
(i)chemical change – disaccharides to monosaccharides
(ii)physical change – evaporation of water.

(i)A small droplet of nectar is regurgitated into the fold of the partly extended proboscis and then swallowed. This procedure is repeated 80 to 90 times until the moisture content of the honey is considerably reduced.

(ii)The un-ripened honey is then hung out to dry in half-filled cells where it is subjected to air currents caused by fanning bees until the sugar concentration is in excess of 80%. The honey is then packed in full cells and sealed with an impervious wax capping.

4.8 The colony needs a fertile queen and the pheromone from open brood to stimulate the collection of pollen. It is the principal source of protein, fat and minerals in the bees' diet. Brood cannot be reared without pollen. It is a body-building material.
When foraging, the bee alights on a flower, its plumose (branched) hairs collect grains of pollen.
The front legs are used to collect pollen from the head and first thoracic segment. It is then moistened with nectar.
The middle legs are used to collect pollen from the front legs and thorax which is then passed to the inner side of the basitarsi on the rear legs.
The rear legs collect pollen from the abdomen to the basitarsus. It is then raked by

the pollen rake at the bottom of the basitarsus and when sufficient is collected, the resulting paste is squeezed by the pollen press on to the hairs of the tibia (pollen basket) for transportation back to the hive.
The pollen is unloaded into a vacant cell by the bee itself.
Water is transported to the hive in the bees honey sac similar to nectar. It is used for cooling the hive, for humidity control and the dilution of honey to 50:50 prior to consumption by the bees.
Propolis is a resinous gum found on trees and some other plants. It is collected and transported to the hive similar to pollen. On returning to the hive propolis carriers have to be unloaded by house bees. Propolis is used to fill cracks in the hive, reduce openings (entrance with Caucasian bees), smooth the hive interior, varnish the interior of brood cells, strengthen comb attachments and cover intruders like dead mice and slugs which are too large to remove.
Propolis is used by man for medicinal and veterinary purposes and for making varnish.

4.9 Swarming is the bees method of colony reproduction, where the colony divides itself and a proportion of the bees and the queen fly off to establish a new colony.
Supersedure is the changing of the queen in a colony without swarming.
The reasons for swarming are:
(i)natural means of increase;
(ii)inadequate supply of queen substance (pheromone);
(iii)ageing or damaged queen;
(iv)congestion, causing restriction in transport of queen substance.
When queen cells are started and populated with a larva and royal jelly, the beekeeper must assume that the colony is preparing to swarm.
After eggs have been laid in queen cups, the queen is given less food, egg laying ceases and she is allowed to slim down ready to fly. When the first queen cell is sealed the queen and most of the field bees will swarm around the middle of the first suitable day. If the beekeeper does not then reduce the queen cells to one, the first virgin queen to hatch will fly off with a cast thus weakening the hive still further.
Prime swarms usually settle close to the original hive and can remain for up to 48 hours before flying off, whilst the scouts investigate possible new homes . Casts seldom cluster for very long before taking off.

4.10 A colony spends the winter in a semi-dormant state. It starts to cluster when the ambient temperature falls below 14degC. On a nice day in winter, bees can leave the cluster for a cleansing flight at a temperature of 7 to 9degC. Bees vibrate their flight muscles in order to generate heat.
Winter bees have fat, carbohydrate and protein stored in their fat-bodies.
Drones are evicted after he main honey flow in August or September.
The queen gradually stops laying, reducing to nil in October/November and starts again in January/February as the days start to lengthen.
The honeybee is immobilised at 7degC and starts to die at 4.4degC. The only way it can survive is by clustering which it starts to do about 14degC.

The outer shell of the cluster is 25 to 75mm thick with a partially filled centre of festooning bees. Heat is generated inside the cluster so that the bees on the outside are maintained at a temperature above 7degC otherwise they would start to drop off. It is essential that the cluster moves slightly during less cold spells in order to maintain contact with its food supply.

5.0 DISEASES, POISONS AND PESTS

5.1 Healthy brood;

Open – pearly- white, nicely curled in a C shape in the bottom of cell. Body divided along length into a series of segments.

Capped - biscuit coloured, dry, slightly domed cappings, not sunken or greasy. Good even pattern with few empty cells (cells with brood at differing stages may however appear towards the end of season due to normal brood casualties throughout the season)

5.2 Describe the signs of the bacterial disease American Foul Brood (AFB) and effects on the colony;

Generally, look for discoloured larvae, perforated cappings, AFB scales on bottom walls of open cells (AFB).

AFB (*Paenibacillus larvae*), generally only affects sealed brood – (AFB = **A** (after capping). Cappings become sunken & perforated (jagged/irregular holes), as the adult bees nibble holes in them to try and remove the dead larvae. Cappings become greasy looking & darker than other cells.

Matchstick inserted into decomposing larvae creates a ropey string as it is withdrawn.

In final stages drying leads to a dark brown rough scale lying on lower side of cell from cell mouth right back to base. Scale adheres strongly to cell wall and can be felt with a matchstick. Suspected signs must be reported to Bee Inspector who may identify it using a lateral flow device and s/he will destroy colony.

Effects on colony - At first colony can appear normal but eventually more and more brood becomes infected causing a pepper-pot pattern. There may be an unpleasant smell associated with decomposition.

EFB (*Melissococcus plutonius*) Usually infects and kills larvae before cell is capped. Some larvae may die after capping giving sunken perforated cappings resembling AFB infection. Bacteria multiply in mid gut and don't invade tissues. May invade a colony and remain sub-clinical for some time.

Difficult to identify visually but dead larvae may be seen twisted uncomfortably in the cell. Larvae look "melted" turning yellowish-brown & eventually drying to a loosely attached "rubbery" brown scale. Creamy white (from bacterial mass), larval gut may be visible through translucent body wall. Patchy brood pattern as dead larvae are removed by adults & Queen re-lays. Very unpleasant odour from associated secondary bacterial infections. Must report to Bee Inspector if suspected, who may identify it using a lateral flow device or by SASA laboratory analysis. Inspector may allow treatment by shook swarm system or may demand destruction in bad cases.

Effect on colony – Signs most obvious in late spring. Colony may recover debilitated

and survive for months or even years. Larval faecal material in bottom of cells remains infectious and is spread by adults as they clean out the cells. Eventually the disease is likely to reach the stage where a high proportion of the brood is affected and the colony will be weakened and ultimately killed. Spread by beekeeper transferring infected combs between colonies.
See also Fera booklet – "Foul Brood Disease of Honey Bees & other common Brood Disorders"
Chalkbrood –Fungus (*Ascosphaera apis*) which enters larva via food or through the cuticle, killing the larva usually after capping. Dead larva is covered with a white cotton wool like growth which then dries out and shrinks to give the characteristic chalk-like mummies which turn grey/black as the fungal fruiting bodies develop. The spores remain viable for up to 15 years and can be spread by beekeepers or drifting. It is reported that the varroacide Apiguard (thymol based) may help to control. Keep strong colonies and replace queens in colonies that consistently show susceptibility. May also appear in stressed colonies in Spring or in hives sited in damp areas.

5.3 Detecting the presence of Varroa (a mite) and describing its effects on the colony including an awareness of the effects of associated viruses;
Use of mesh floors to detect natural death mite drop in order to gauge mite population. Keep population below 1000
Pulling out drone brood with uncapping fork to gauge mite population.
Monitor at least 4 times per year. Early spring, after the spring flow, at the time of the honey harvest and in late autumn. Monitor all colonies.
State methods of keeping mite population under critical limits using Integrated Pest Management (IPM) techniques i.e control at several points of the year to make it harder for population to reach harmful levels, use management methods to reduce need for varroacides, use different treatments from year to year to prevent resistance building up in mite population, alter control strategies to reflect changing infestation levels. Monitor for varroacide resistance using e.g.Beltsville test.
Treatments vary from Biotechnical (drone brood removal, comb trapping, artificial swarm, open mesh floors), Natural miticides such as Thymol, Organic acids (Oxalic-can't penetrate sealed brood, Formic – caution need) and synthetic insecticides/miticides, e.g. synthetic pyrethroids
Viruses – Deformed Wing Virus(DWV) and Acute Bee Paralysis Virus (ABPV) are particularly associated with varroa. High viral load will subdue and may overcome the bee colony.

5.4 Awareness of acarine (a mite), nosema (a microsporidian fungus) and braula (a wingless fly) stating their effects on the colony;
Acarine – *Acarapis woodii (Rennie)* Mite which, lives, breeds and feeds (by puncturing the body tissues and sucking the haemolymph) in the bees' tracheal tubes, eventually blocking airways and introducing harmful viruses. Mature females climb onto hairs of passing young bees (less than 7 days old) and enter the thoracic spiracles. Can be detected by removing head and front legs and viewing thoracic tubes through a dissecting microscope. Varroa treatments help to suppress.

Nosema – *Nosema apis & Nosema ceranae* – Fungal microsporidian that invades the intestinal duct, debilitating the bee and sometimes causing dysentery which exacerbates the spread. *N apis* tends to be a winter/spring disease. Reduced by having strong vigorous colonies

Braula coeca , sometimes called the bee louse (although it is not a louse) is a wingless fly which is relatively harmless, living on the bee and stealing food during trophylaxis (food sharing). However it can build up on the queen to the point where it is debilitating. It is seldom seen since the arrival of varroa as the varroacides kill it.

5.5 Able to describe ways of controlling Varroa using integrated pest management techniques;

It is recommended that tutors use the National Bee Unit document "Managing Varroa" to teach this part of the syllabus, as it has all the latest methods and treatments outlined. It can be accessed via Beebase. However ensure that students are familiar with detection methods (mesh floors, drone uncapping and a knowledge of which treatments to use at different times of the season.

5.6 Aware of current legislation regarding notifiable diseases and pests of honeybees;

There are currently (Sep 2014), 4 notifiable diseases/pests:
AFB, EFB, Small Hive Beatle and Tropilaelaps.
Suspected presence of any of these must be reported to your local Bee Inspector (a Scottish Government employee), whose contact details can be obtained via the Beebase web site or from the Science & Advice for Scottish Agriculture (SASA) bee laboratory in Edinburgh.

5.7 Awareness of the national and local facilities which exist to verify honeybee diseases and advise on treatment;

National: SASA Laboratory in Edinburgh, also the National Bee Unit in York.
Local Bee Inspectors will have field detection kits (Lateral Flow Devices) for the Foul Brood diseases. And will instruct what action is to be taken on the confirmation of these diseases.
Floor scraping samples can also be sent to the SASA bee lab in Edinburgh.

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

Contact SASA & send sample of 200 to 300 dead bees. Keep a further one or two samples under refrigeration, in case they are required later for verification.

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

Used brood combs are more susceptible to attack by wax moth than super combs. Seal and fumigate with a sulphur burn strip (Sulphur dioxide) or use glacial acetic acid. Note acetic acid is highly corrosive –remove metal parts and wear protection. Wax moth can also be controlled by using a biological control called Certan (Bacillus thuringiensis) which kills the wax moth grubs.
Keep the boxes of frames sealed in polythene refuse bags containing some Certan.

Supers stored ‘wet’ are less liable to attack, but come out of the store very messy in spring. A bonus is that the bees readily occupy these wet combs in spring to clean out the fermented honey.

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

By mid October, apply mouseguards. Proprietary metal guards have 9mm diameter holes which is the maximum size of round hole guaranteed to exclude mice. Alternatively use entrance blocks with an opening no higher than 7mm.

In areas where green woodpeckers are prevalent, hives may have to be protected with wire mesh.

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