

## Bee-Centred vs Conventional Beekeeping

In large parts of the world, honey bees are struggling to remain healthy and vigorous. The need constantly to administer chemical treatments and to import bees from afar to replenish losses indicates that we are in an unsustainable situation. In contrast to trying to fix the problem through ever more intervention, the NBKT starts with the premise that understanding, respecting and supporting the essential biological needs of the bee in a holistic manner is fundamental to having healthy bees. We call this bee-centred beekeeping. This style of beekeeping is firmly based on the biology of the honeybee and is very different from the style of beekeeping taught to beginners by conventional beekeeping organisations, such as the BBKA. We are often asked to detail the differences between the two approaches, so we have put together the following article.

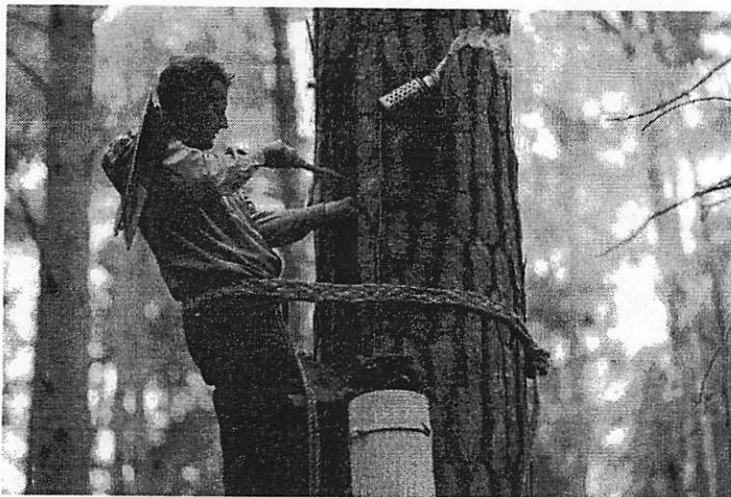
For those wishing to read the science that underpins what follows, we recommend the following books: 'Honeybee Ecology', 'The Wisdom of the Hive' and 'Honeybee Democracy' by Tom Seeley, 'The Buzz about Bees' by Jürgen Tautz and 'The Biology of the Honeybee' and 'Bee Time' by Mark Winston. An extensive list of extracts from scientific papers relating to bee biology and natural beekeeping is presented here.

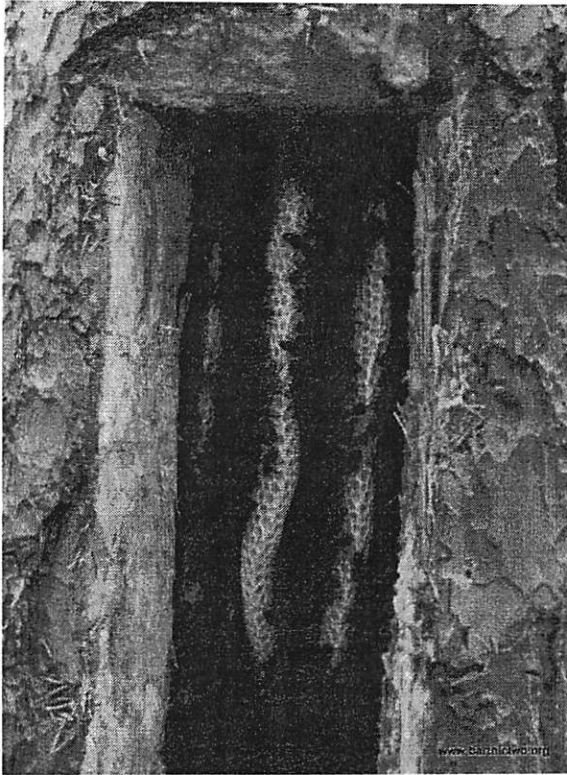
When we talk about conventional hives, we mean hives such as the Langstroth or National. 'Conventional beekeeping' means beekeeping techniques as taught to hobbyist beekeepers by the British Beekeepers Association ('BBKA'). Even in the UK, not all beekeepers follow the teachings of the BBKA, but since the BBKA approach is promoted as the methodology to which new beekeepers should aspire, it is as good a reference as any.

*With thanks to Dave Darby at LILI for prompting us to produce this comparison.*

### The Beekeeping Spectrum

When it comes to keeping bees, it is entirely possible to put a box in a tree, or even to hollow out a tree to attract a swarm and, if one arrives, allow the bees to just get on with it. Such tree beekeeping is a fully viable approach from the viewpoint of the bees and is a practice that is being rediscovered across several European countries.



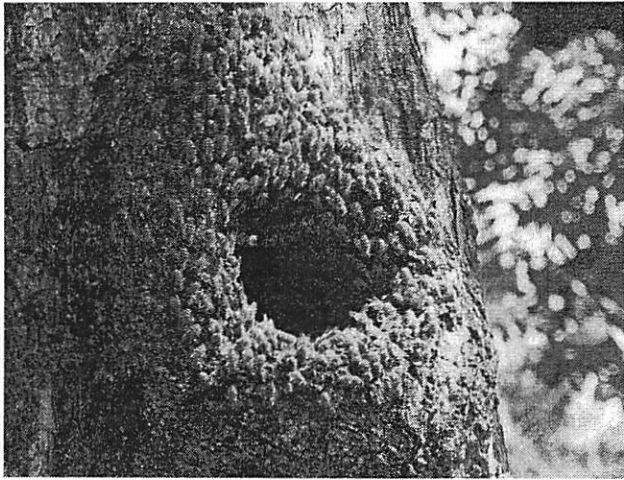


Tree beekeeping forms one end of a spectrum. At the other end of the spectrum is large scale industrial commercial beekeeping. In between is conventional hobby beekeeping. So-called natural beekeeping sits between conventional hobby beekeeping and tree beekeeping.

Within the spectrum there are nuances. For example, commercial beekeeping does not have to be highly industrial and intensive. It can be extensive and far less intrusive upon the bees. Hobby beekeepers can range from those who 'manage' their colonies more intensively than some commercial beekeepers through to those who are relatively hands-off. Natural beekeepers will generally be less intrusive than conventional beekeepers. However, even here, there are degrees. One well known UK beekeeper who previously styled himself as natural has recently renamed his approach 'balanced': he adopts many techniques used by conventional beekeepers. Bee-centred beekeeping is a form of natural beekeeping that sits at the end of the beekeeping spectrum next to tree beekeeping.

## **Bee Hives**

Perhaps the most important thing that a beekeeper does for their bees is to provide shelter. What do honey bees need by way of shelter? One hears of swarms moving into all sorts of strange containers. This is sometimes interpreted as meaning that almost any container will do. An alternative explanation is that bees are conditioned by their evolutionary past to appraise any potential home as if it were a hollow tree and that this can lead to strange, and not always appropriate, choices. In the millions of years before man-made structures appeared, it seems reasonable to assume that hollow trees would have been the predominant bee shelter, with perhaps caves coming second in some localities. In other words, bee behaviour is likely to have evolved to suit living in hollow trees.



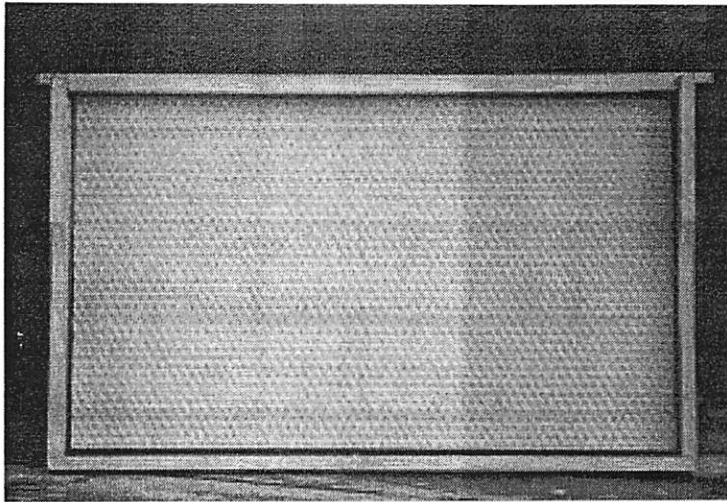
Despite the preference of park keepers for trees that are solid, in natural conditions, many older trees have hollow insides. The cavities thus created are vertical in orientation and generally have thick walls, giving a high level of thermal insulation between the cavity and the outside air.

Tom Seeley's work shows that:

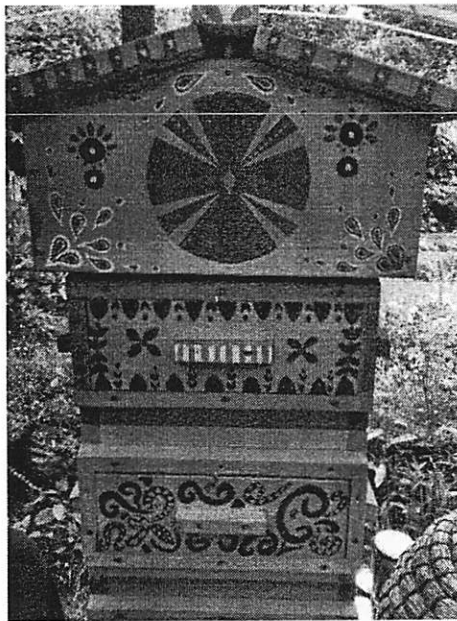
- Swarms prefer cavities with a volume of around 40 litres over cavities that are substantially smaller or larger than this and generally prefer cavities that are around 3 metres or more from the ground.
- The swarm starts building from the top of the cavity and extends its combs downwards. (The alternative would be to start at the bottom and build upwards; it would be problematic to start in the middle.)
- The bee colony typically builds half a dozen long combs, perhaps reflecting the fact that tree cavities tend to be much longer than they are wide.
- These combs are fixed to the sides of the cavity at intervals. The bases of the combs hang freely and are shaped in a catenary curve.
- Different cell sizes in the combs are used for storage, the raising of worker bees and the raising of drone bees (the latter comprising perhaps 15% of the total). Special cells for raising queens -queen cells- are constructed on the hanging part of the comb at the base of the colony.
- The interior of the cavity is coated with a layer of propolis, a sticky resin collected from trees and shrubs.

Comparing such a natural bee hive with a hive provided by beekeepers, the first difference we see is that conventional hives are expanded upwards, reversing the natural inclination of the bees to start at the top and grow their colony downwards. This leads to the bees constantly attempting to move upwards into the empty space that is placed above them. To prevent the whole colony from moving upwards, a mesh queen excluder is generally inserted into each hive. This acts as a physical barrier for the queen and prevents egg laying and the rearing of brood in the upper boxes. The response of the bees is to fill the boxes above the queen excluder with honey, which is later harvested by the beekeeper.

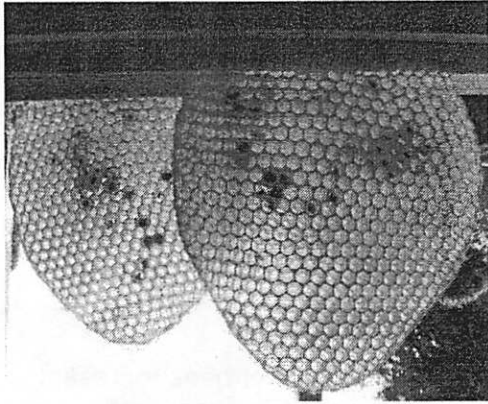
The second difference is that conventional hives are filled with frames fitted with **foundation** - sheets of wax or plastic impressed with the shape of worker cells and reinforced with thin wires.



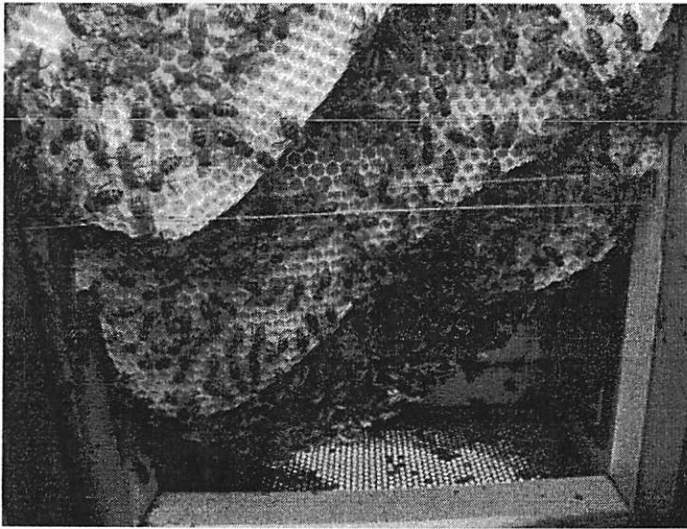
One reason for using foundation impressed with worker cells is to prevent the bees from raising drones. Drones are male bees and are raised in larger, drone, cells. Drones do not gather honey and their production is seen as a waste of energy by the bees, energy that could otherwise go toward collecting honey. In fact, drones have a very important role to play in the production of healthy bee colonies, but more on this later.



Bee-centered hives of the sort preferred by the NBKT do not force a colony to expand upwards, nor do they involve the use of foundation. (It is worth mentioning that one US study showed foundation to be contaminated with dozens of toxins from beekeeper treatments and agricultural practices). Rather, the bees are provided with simple top bars and allowed to build comb of their own choosing, in a downwards direction from the top bar.



Not only does this make life simpler for the bees, it also makes it simpler, and less expensive, for the beekeeper. Two examples of such hives are the Warré hive and the Einraumbeute. The former is a vertical hive, in which additional boxes are placed under existing boxes, to allow for downwards expansion. The latter is a deep horizontal hive. The depth of the hive allows for a degree of vertical expansion of the bee colony, but avoids the need for boxes to be lifted. Due to its depth, the Einraumbeute is used with frames, in which the bees build their own natural comb.



It is to be contrasted with the Kenyan top bar hive ('KTBH'), which is a shallow horizontal hive and is not recommended by the NBKT for use in cool damp conditions such as prevail in the UK. The question of bee appropriate hives is discussed in more detail in this article on our blog. For more about comb building see [here](#).

Both the Warré hive and the Einraumbeute make use of top cloths above the top bars. The bee colony covers these with propolis, as it does the interior of a hollow tree. Neither the KTBH nor conventional hives use a top cloth. Conventional beekeeping generally frowns upon the use by the bees of propolis on the basis that it gums up the hive and makes it difficult, or at least inconvenient, to take the hive apart.

## Bee Physiology

That part of a bee colony where young bees are raised has a similar temperature to the body temperature of a mammal. This fact, combined with the raising of young internally, and various other mammal-like characteristics caused the biologist Jürgen Tautz to:

'propose that a honeybee colony is not only equivalent to a vertebrate, but in fact to a mammal, because it possesses many of the characteristics of mammals.' *Prolog from The Buzz about Bees*

Moreover, Tautz follows the concept of Johannes Mehring (1815 - 1878) that:

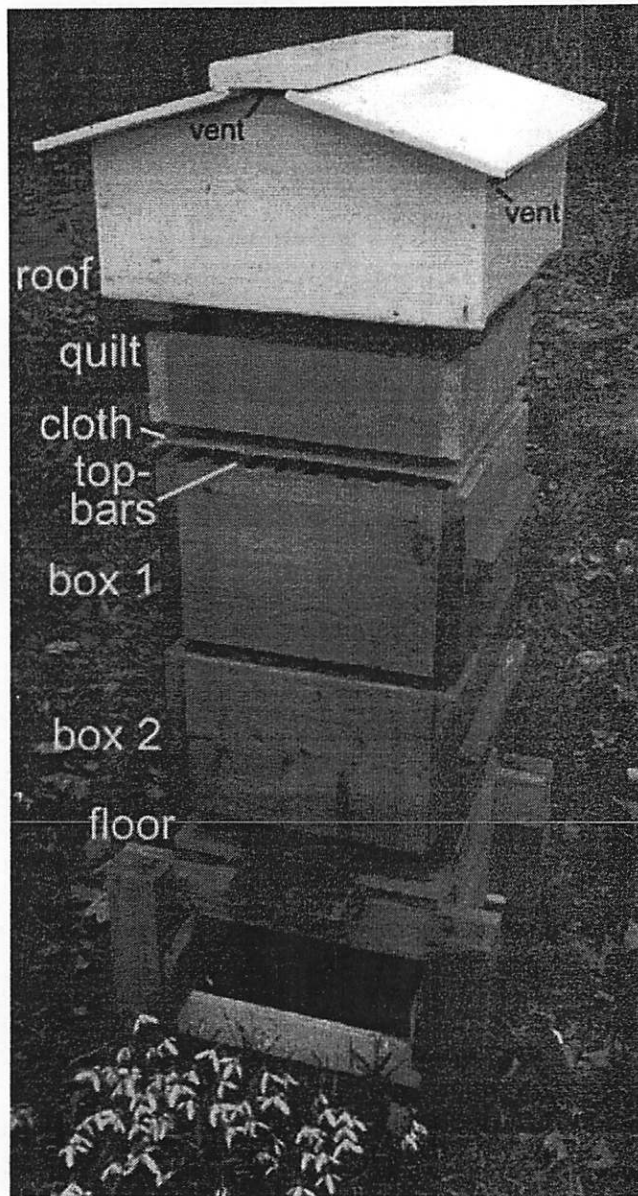
'a bee colony is a single "being", equivalent to a vertebrate animal. The worker bees represent the body organs necessary for maintenance and digestion, while the queen and drones represent the female and male genital organs.' *ibid*

Tautz proposes the use of the term 'superorganism' to describe the whole, a term coined by the biologist William Morton Wheeler (1865 - 1937).

Seeing a bee colony as a single whole, as a warm blooded mammal, gives a very different perspective from that of seeing such a colony as being 'just a box of insects' as some conventional beekeepers have been heard to remark. A mammal has a need for warmth and stability of home environment in a way that is difficult to conceive as applying to a box of insects. A bee colony maintains its internal temperature through shivering; specialist bees, called heater bees, are particularly good at this. One does not see the bees shivering, they do it internally using their wing muscles and burning honey as their energy source. The effect is the same as when a mammal shivers: heat is produced. Heat is key to raising young bees and research shows that the temperature at which bees are raised leaves lasting effects on them in later life.

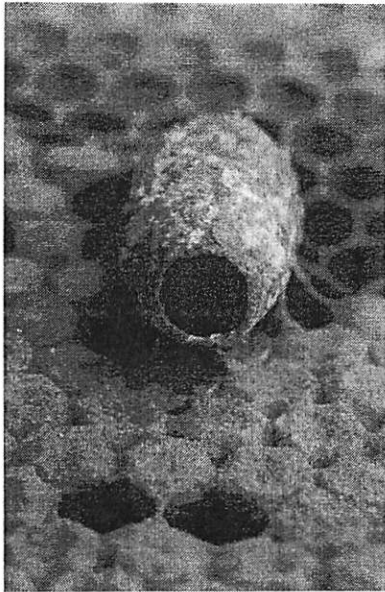
Apart from heating the brood area, various other bee activities produce heat. For example, heat is produced when the bees secrete wax and build honeycomb. In a tall thick-walled tree hollow, one can imagine the heat thus produced moving upwards through the colony by convection. The insulating properties of the thick walls will ensure that the heat is retained. Any excess is ventilated out of the entrance (generally located towards the bottom of the hollow) by bees fanning their wings. It is easy to imagine the bees evolving over the millennia to work with the natural flow of convection within the hive.

The Warré is a vertical hive of limited cross section designed to mimic the heat retention and distribution capacities of a hollow tree, being fitted at the top with a quilt of wood shavings or similar to retain the heat of the hive. Here is an exploded view, courtesy of David Heaf:



Although it is possible to fit a quilt to a conventional hives, and such things have been suggested in the past, one almost never sees such a thing and certainly not in the bee supply catalogues. Maybe it's that 'insects in a box' viewpoint coming through.

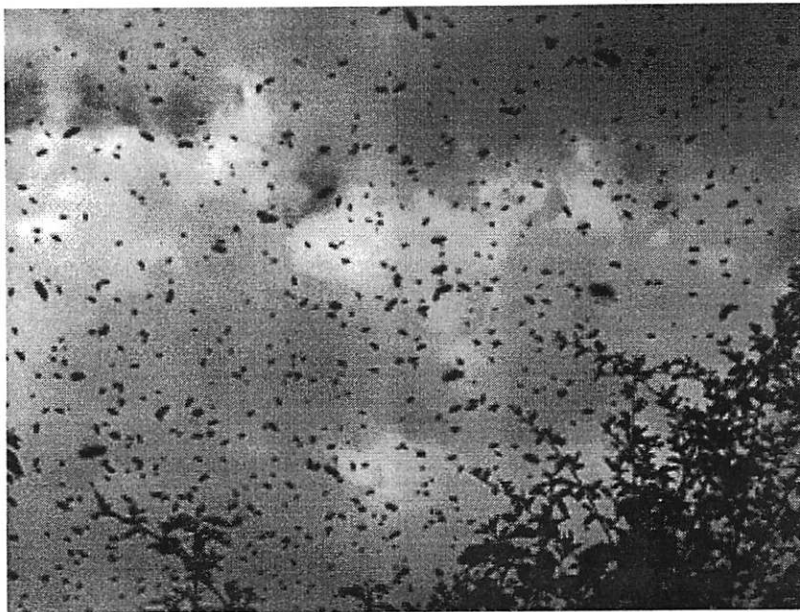
Seeing the bee organism as a warm-blooded whole makes bee-centred beekeepers wary of frequent hive openings. They open hives only on those occasions when an external examination suggests that it is likely to be beneficial to the bees - a rare occurrence. By contrast, conventional hobbyist beekeepers are taught to open their hives frequently; once a week during the swarming season to check for and destroy queen cells such as this one:



In the process the internal conditions of the hive -such as heat, humidity, carbon dioxide and hormone balances- are all greatly disturbed or entirely lost. Frequency of hive opening is one area where commercial beekeepers sometimes have more in common with the bee-centred approach than with the hobbyist approach; they simply do not have time to open their hives on a frequent basis.

### **Bee Reproduction**

The bee superorganism reproduces through a process termed swarming. Swarming starts when the bee colony forms special cells termed queen cells. These are vertical, rounded cells used only to raise new queens and are quite different in shape from the hexagonal cells in which worker or drone bees are produced. As the queen in the queen cell starts to mature, the 'old' queen leaves the hive with a portion of the bees. This is the swarm.



The swarm generally settles in a cluster near the hive while it seeks a new place of shelter - a new home.



It is at this stage that the observant bee-centred beekeeper can 'take' the swarm and 'run' it into a new hive. This involves collecting the swarm and placing it on a board at the entrance of a new hive. If the scout bees from the swarm feel that the new hive is acceptable, the whole swarm moves in. Doing this is one of the most satisfying things a beekeeper can engage in; it is equivalent of being present at a birth.



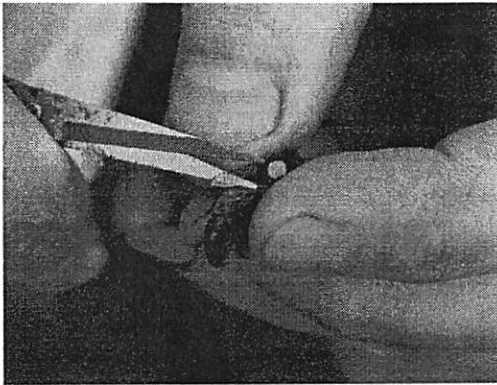
By contrast, conventional beekeeping teaches that swarming is a nothing short of a nuisance and is to be 'controlled', or even eliminated. This seems an odd view; it is rather like a shepherd saying that they do not want lambs. Swarming is the method by which the bee reproduces in exactly the same way that lambs are the way in which sheep reproduce. Swarm suppression is often justified on the basis that it increases honey yields; but beekeepers who allow swarming and operate an extensive rather than an intensive beekeeping system dispute this. Moreover, bee-centred beekeepers are not generally honey-driven, seeing the bee as a pollinator first and provider of honey second.

The following swarm control methods are advocated by the BBKA:

- Thorough inspections of the hive at least every 7 days during the swarming season of May and early June, to search for queen cells. Any queen cells found are destroyed. To

be fully effective, it is advocated that the bees be shaken from their combs. This is a stressful activity for both the beekeeper and the bees, causing considerable disruption to the orderliness of the hive. Not surprisingly, many beekeepers find themselves unable to adhere to such a regime. If a queen cell goes unnoticed, the colony swarms in any event and the disruption has been wasted.

- The wings of all queens are cut (the euphemism is 'clipped') to prevent the queen from flying with any swarm that does issue. Since the inspection regime often fails, conventional teaching often insists that clipping a queen's wings is an essential part of swarm control: beginner beekeepers are required to show proficiency in this aspect of beekeeping if they wish to pass the BBKA exams. They are encouraged to practice the technique on drones.



Even wing clipping is not fail safe. It merely buys time. The queen, unable to fly, falls into the grass and the swarm returns to the hive, often in an agitated state, or else assembles around the stranded queen on the ground. As soon as a new queen (complete with wings) emerges from her queen cell, the hive will swarm again; this time successfully. So the beekeeper has to intervene before this happens and apply further management techniques, often dividing the colony into two: which is exactly what the bees were trying to do in the first place. Natural beekeepers are sometimes castigated for allowing uncontrolled swarming; allowing their swarms to fly off to take up residence in roofs and disused chimneys. As we have seen, no method of swarm control is fully bee-proof and conventional beekeepers most certainly lose swarms; even if they are loath to admit it. Indeed, if they are relying on swarm control, they may not even be aware of losing swarms. By contrast, the natural beekeeper will look out for swarms. They will keep a close eye on their bees during the swarming season and, with experience, will know when they are about to swarm. In addition, they will place bait hives and other attractants to encourage the swarm to stick around rather than decamp to a nearby roof.



In other words, they will work with the bees rather than against them. The active swarm seeker also works with their neighbours and local community, who thus become engaged with bees and swarms, seeing them as natural, and desirable, rather than as a scene from a Hollywood horror film. Rarely are swarms anything other than placid; unlike an established colony, they have no honey stores to defend.

### **Artificial Reproduction and Queen Breeding**

Even some beekeepers who term themselves natural engage in some of the following practices, although it is unlikely that anyone who terms themselves bee-centred would do so, as what follows is anything but bee-centred. One might also conclude that it is anything but natural!

The natural process of bee reproduction has been outlined above. It starts with that special cell, the queen cell. Artificial reproduction eschews the queen cell as the starting point and begins with an egg or young larva from a worker cell; that is an egg or larva that has started its life with the aim of becoming a worker bee. The logic is that both worker bees and queen bees are female and that the former can thus be tricked into becoming the latter. This misses the point that the bees could themselves just as easily convert a worker egg or larva into a queen if they so wished but, under normal circumstances, they do not. They go to the trouble of creating nascent queen cells (called queen cups) into which the queen lays an egg directly. One might suspect that there is a reason for this.

However, the bee colony has a rather special emergency repair mechanism that it can call on in times of dire need. No need is more dire than the sudden loss of a queen; there is generally only one in each hive and without a queen, a hive will slowly perish.

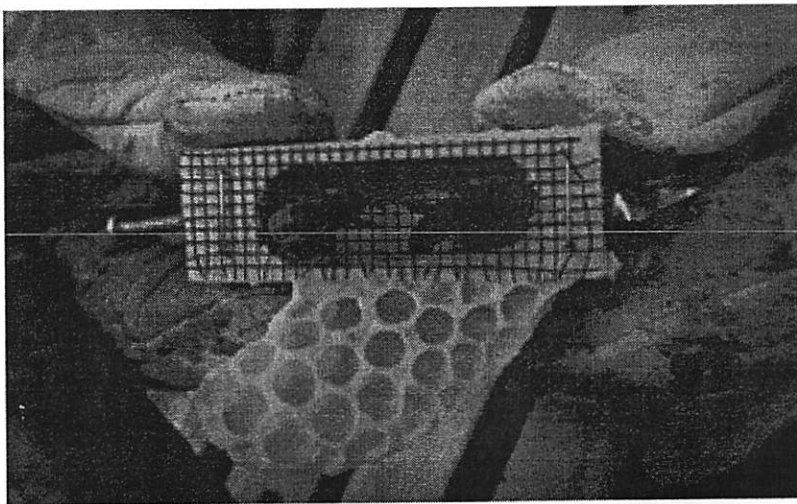
Conventional beekeeping **routinely uses this emergency repair mechanism** as a means of producing more bee colonies. Perhaps not surprisingly, this goes hand in hand with **suppressing natural reproduction by swarming**.

The simplest way to **trigger the emergency repair process** is to divide a colony into two (a so-called split). Half the colony will then be without a queen and will react by converting an egg or larva that was destined to become a worker bee into one that becomes a queen bee. In physical terms, the bees tear down the worker cell and construct a queen cell around the egg or larva within, thus raising an emergency queen.

A beekeeper can go further than this, however and trick a colony into raising many queens using this **emergency queen production process**. This is what so-called queen-breeders do.

The queens produced are mated and sold to other beekeepers. They may be sold as queens in cages, or as 'nucs' or as packages. Nucs (short for nuclei) are small colonies. The bees in the colony may not be related to the queen; frequently she will have been 'introduced' shortly before the nuc is sold. Packages are not common in the UK, but in a package, the bees are most certainly not related to the queen and are generally not related to each other, having been shaken together from several colonies. Unsuspecting purchasers probably view a package as equivalent to a swarm, which it most certainly is not. In a swarm all the bees are related to each other and to the queen that accompanies them.

The purchasers of caged queens are often beekeepers who have run into problems adhering to the rigorous swarm control procedures mentioned above. They buy new queens because they believe that young queens are less likely to swarm. So they replace the queens in their hives every year with a new one. They may also buy queens because they believe a new queen will give more honey or because they have heard that such and such a strain of bee is just right for them.

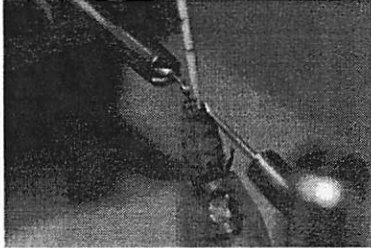


The fact remains, whether the purchase is of a nuc, a package or a caged queen, the queens concerned were never destined to be queens when laid as an egg. They are a product of a change of mind forced on the bees by the action of the beekeeper: hence the comment that the entire proceeding is anything but natural.

Matters do not end there, however. Queen breeders are under pressure to produce queens with 'desirable' characteristics. Amongst the characteristics that are sought after by beekeepers are docility, prolific honey gathering, limited use of propolis (remember that gluey stuff that is good for bees but most inconvenient when performing those weekly inspections to look for queen cells), colour and the pattern of veins in bees' wings. Setting aside the question of whether these characteristics are good for the bees (as opposed to the beekeeper), how does one ensure that the queens one produces have them?

Queens mate on the wing and the progeny they produce -the bees that make up the hive- result from a combination of the queen's genes with those of a drone (male bees). Virgin queens mate with a dozen or more drones and store the sperm in a special sack for use during their lifetime. Queens will not mate with closely related drones and outbreeding seems essential in maintaining health and vigour in bee colonies.

Queen breeders may flood an area with selected drones in an attempt to influence the mating of their queens or they may go further and inseminate their queens with a machine. The latter requires anaesthetic (for the queen), a microscope and highly specialised micro-manipulating equipment.



For those interested, here is a training video for the procedure.

Whether the area is flooded with drones or the queens are machine inseminated, practical constraints on the number and variation in drones used by the queen breeder mean that the hapless queen is unlikely to be inseminated by the same spread of drones as she would mate with naturally. In other words, in comparison with a queen freely mated under natural conditions, she will be inbred. Over time, queen breeders tend to see a decline in vigour in their queens and have to bring in fresh stock to restore vigour to their breeding lines. It can be argued that the decline in the vigour of bees generally is due, at least in part, to **inbreeding over many generations**. For example, in the US it is said that most commercially available queens originate from only a handful of large-scale queen breeders.

A queen produced by these procedures will have a paint blob applied to her back for identification and will likely have part of one wing cut off to prevent the colony of which she is part from ever swarming, ie reproducing naturally. So the cycle continues.

## Pests and Diseases

### *Varroa*

The most common pest that affects bees around large parts of the world is the parasitic varroa mite. This mite originates in Southeast Asia. The bees that live there are closely related to the honeybee we are used to in the west. The honeybees of the Southeast Asia live quite happily with varroa. Varroa jumped species to the western honey bee some time in the mid 20th century when beekeepers transported western honey bees to the Far East. Varroa found it could survive in colonies of the western honey bee, but colonies of the western honey bee found they could not survive with varroa. This frequently happens when a parasite or disease jumps species and it takes a while for a new balance to be established. In the meantime, losses can be high. Gradually the mite has spread around most of the world, helped greatly by the international trade in bees.

Varroa mites feed on the blood ('haemolymph') of bee pupae and adult bees. This weakens the bee and also transmits viruses to it. These viruses are thought to be a major cause of the collapse of bee colonies that are heavily infested with varroa. Beekeepers attempt to control the level of varroa in their bee colonies by using various chemical treatments, ranging from 'hard' treatments through to 'soft' ones. The hard treatments include wax soluble insecticides such as fluvalinate ('apistan') or coumaphos (sheep dip). Softer treatments include essential oils and icing sugar, and organic acids, such as oxalic acid or formic acid. The hard treatments are often

avoided by beekeepers who do not like the idea of putting wax soluble insecticides into a beehive that contains both wax (the honey comb) and insects (the bees). Studies in the US have shown that beeswax is extensively contaminated with miticides (as well as all sorts of other toxins used in farms and horticulture). Deleterious effects on bees can occur through the use of both hard and soft treatments, especially if administered incorrectly. Nevertheless, it is the official preference in the UK that bees should be treated for mites and the vast majority of both conventional and natural beekeepers do so: but not all.

In the UK, frequently beekeepers who do not treat find something that goes against accepted wisdom: not all their colonies die. In fact, such data as there is indicates that colony deaths are the same, or lower, in untreated colonies when compared with treated ones. This data collected over 4 years in an area of Wales shows that winter losses in treated colonies were on average 50% higher than in non-treated colonies. (Yes, treated colonies have a higher mortality than untreated ones!) The sample size is significant, covering an average of over 250 colonies a year. Treated colonies make up 60% of the total in the first year, falling to 20% in the last year. It seems that, as the news about treatment efficacy, or the lack of it, has spread, so the number of treaters has fallen. **This being the case, why do not all beekeepers seek to get off the chemical beekeeping treadmill and stop treating?** Here, here and here are some thoughts from others on the subject.

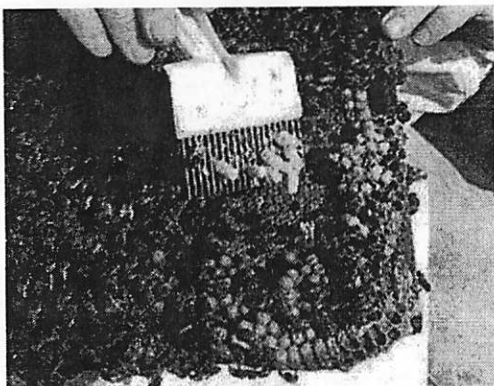
The answer has as much to do with psychology as biology. A lot of beekeepers treat 'just in case'. However, 'just in case' has a downside. The Welsh data referred to above is supported by research that indicates that bees as well as varroa are adversely affected by varroa treatments. One well known conventional beekeeper who lives near Swindon and looks after as many as 80 colonies gave up treating because he became convinced that **queen fertility was suffering due to the treatments.** He had a choice: continue treating and keep losing colonies due to queen failures, or stop treating and see what happened. He decided to try the latter. To his great surprise, not only did he not lose all his bees, but of those that survived, some colonies flourished. Since then he has remained treatment-free. On the day I visited him a few years ago, he could not find any varroa in his bee hives to show me! He sources his bees from swarms thrown by wild colonies, the reason being that such colonies have not been treated and, if the bees are thriving enough to throw swarms, they have at least a degree of varroa tolerance.

Research on the island of Gotland (in the Baltic sea) and near Avignon shows that, even in the most unpropitious circumstances, bees develop varied mechanisms that allow them to control the varroa population in their hives. I myself have not treated any of my hives for a number of years. Between my own hives and those of other non-treatment beekeepers that I know well, I can count between one and two hundred untreated hives that have varroa losses that are at completely acceptable levels.

Experience shows that varroa tolerant bees, if allowed to open mate with little or no control over the drones they encounter are quite **capable of passing varroa tolerance to their offspring.**

Recent work at Sussex University supports this finding. Yet, non-treating beekeepers are regularly decried as being spreaders of varroa from their 'infected' colonies. In reality, non-treating beekeepers whose colonies are healthy are doing their neighbours a favour; they are providing a source of drones that are available to spread varroa tolerant genes to queens from their neighbours' hives. Except, as we have seen, many conventional beekeepers do not allow their queens to open mate; they buy queens from queen breeders already mated. So the mechanism by which varroa tolerance could be spread is stifled.

This mechanism is further stifled by some of the practices used by treatment beekeepers in their management regimes; practices such as drone culling. In drone culling, hives are opened on a regular basis and drone pupae are mechanically removed from the brood area and destroyed.



This is done because varroa reproduce preferentially in drone brood. However, it will be recalled that conventional beekeeping uses worker foundation in hives to suppress drone production. So, to make drone culling effective, the beekeeper must first insert some drone foundation into the hive. This then acts as a trap for the varroa mites, who are attracted to the drone brood... which the beekeeper later destroys. However, if one has bees that are naturally varroa tolerant, the ejection of infected drone pupae happens naturally - the bees do it for themselves. What is more, healthy drone pupae are left to develop into adult drones and are available to mate with queens, passing on their genes, all with no input from the beekeeper. In comparison, **drone culling is a blunt instrument** that involves a lot of work.

Conventional beekeepers who seek **large harvests of honey**, or who have **early pollination contracts** stimulate their bees early in the spring by **feeding sugar syrup**. The effect of this is that the queen starts laying earlier than would be the case under normal circumstances and the colony grows rapidly. A rapidly growing colony has lots of brood and, since it is in brood cells that varroa reproduce, lots of varroa too. The same beekeeper may well follow up with drone culling to reduce the varroa population that has been stimulated by the feeding of sugar syrup.

One can see why a certain commercial beekeeper, who was also a bee inspector, was heard to comment that 'varroa is a problem of forced bees'.

### *Brood Diseases*

There are two diseases that affect the brood of honey bees: European and American Foulbrood. Generally abbreviated to EFB and AFB, the names have nothing to do with where the diseases occur. Of the two, AFB is regarded as the more problematic because the causative bacterium forms spores that are both extremely long lived and extremely tolerant of cleaning agents. Both EFB and AFB are notifiable in the UK: the law requires that their suspected presence be reported to the appropriate authority.

As with the varroa mite, natural beekeepers are often regarded as a source of infection for these two diseases. This viewpoint rests on two assumptions: that natural beekeepers are ignorant of the health of their colonies and that natural beekeeping *per se* promotes unhealthy bees. The second of these two assumptions rests on the fallacy that bees need constant beekeeper input to remain healthy. We have already seen that, in the case of conventional beekeeping, as taught by the BBKA, constant input actually means constant disruption and stress. EFB in particular is known to manifest when a colony is stressed. Adding beekeeper induced stress to the mix can only make matters worse. Doubtless, conventional beekeepers would argue that their methods do not cause stress but, as we have seen, conventional beekeepers ignore such vast amounts of bee biology that one is tempted to wonder how they would even recognise a stressful situation for a bee colony.

This leaves the first objection, that natural beekeepers are ignorant of the health status of their colonies. The thought behind this is that all natural beekeepers leave their hives completely alone and never look at them. Beekeeping that leaves bees completely alone might be better termed bee conservation rather than bee keeping: it rests on the viewpoint that honeybees are a wild (rather than domesticated) creature. As such, they should be treated like similar species; if one puts out nest boxes for wild birds it is not necessary (and may even be harmful) to then inspect them for disease. The same approach is applied to bees. Whilst some will disagree, this seems a valid viewpoint in its own terms, ie that honeybees are a native wild species, at least in the UK.

Turning to those beekeepers who wish to interact with their bees to a greater degree than the bee conservators, there are degrees of observation that can be employed to determine the health of a colony. The first is to observe acutely the activity at the hive entrance. Hives with observation windows allow a second degree of observation. With experience one soon ascertains when a colony is less active than would be expected for the season. This might lead to a more intrusive inspection of a colony. The Sun Hive, Warré hive and Einraumbeute are all designed to allow a full inspection if deemed appropriate. This can include a comb by comb examination. In this regard, therefore, with appropriate care, a hive kept naturally can be inspected to just the same extent as a conventional hive. It is worth noting that the internal construction of a conventional hive can make it very difficult to inspect if left untended for a year or two (a not infrequent situation) due to the number of wooden surfaces that become glued together with propolis. The internal construction of a Sun Hive, Warré or Einraumbeute makes this much less of a problem.

## **Harvesting Honey and Feeding Sugar**

Even hobbyist conventional beekeepers are encouraged to harvest the maximum amount of honey. Data is collected and published each year by beekeeping associations that measures the average honey yield per hive and high yields are seen as a mark of successful beekeeping. 'How much honey do you get?' becomes the yardstick by which beekeeping prowess is measured. Of course, not all get drawn into this competition, but many do. They take as much honey as they possibly can and substitute sugar water as winter feed. Sugar water is seen as equivalent to honey. Yet it is anything but. Honey contains many dozens of micro-nutrients that are not present in sugar water. It also has a higher acidity. Photomicrographs of the stomachs of bees fed on sugar water look very different from bees fed on honey. Whereas the latter are plump and shiny, the former are small and shrivelled. Yet one hears it said that sugar and honey are equivalent!

Concomitant with feeding sugar water to replace honey taken by the beekeeper is the feeding of sugar water to stimulate non-seasonal growth of bee colonies. Not only does this cause the bees to get out of synchrony with their natural environment, as mentioned above, it has the effect of stimulating varroa growth too. The result is stressed bees and a high varroa load.

Bee-centred beekeeping carefully assesses the amount of honey present in a colony and only harvests that which is genuinely surplus, leaving the bees plenty of honey to survive the winter. For an inexperienced beekeeper, it is always wise to err on the side of caution and leave more honey rather than less until one knows one's bees and local climate. Sugar water is only fed in poor summers when bees would otherwise starve and it is generally supplemented to make it more akin to nectar in its chemistry and nutrient content.

## **Bee Importation**

Bee-centred beekeepers aim to have bees that are well adapted to their local environment. In the UK, this means bees with a high proportion of native bee in their genes. Sub species of bee imported from other European countries come from different climates and are less suited than our native bees to our rather wet maritime climate. Yet the belief that imported bees are 'better' still persists and bees are imported in great numbers every year. This is one area where many conventional beekeepers agree with bee-centred beekeepers; yet those at the upper levels of the beekeeping hierarchy seem uninclined to oppose bee importation.

In those countries where the bee is not native, the need to have a bee that is well adapted to the local climate is still relevant. Shipping bees each year across huge distances from locations that have a completely different climate makes no sense: far better to stick to locally bred bees that are adapted to their local conditions.

Then there is the issue of pest and diseases. When bees are shipped around the world, pests and diseases travel with them. Varroa is a classic example of a pest that has spread around the world with imported bees.

## **Conclusion**

In conclusion, one could say that the practice of conventional, chemically supported beekeeping largely relies on exploiting the bee superorganism's tremendous plasticity - the very quality that has made possible the specie's survival over millennia. Yet all plasticity has its limits and those of the bee have been reached and surpassed, as reflected in the bees' dismal situation today.

It is well past time that we returned to the basic biology of this wonderful creature and started to care for it in a manner that supports it for the long term, rather than exploits it in the short term. Only then will we bring the bee back into the vibrancy the bee deserves and the world needs.

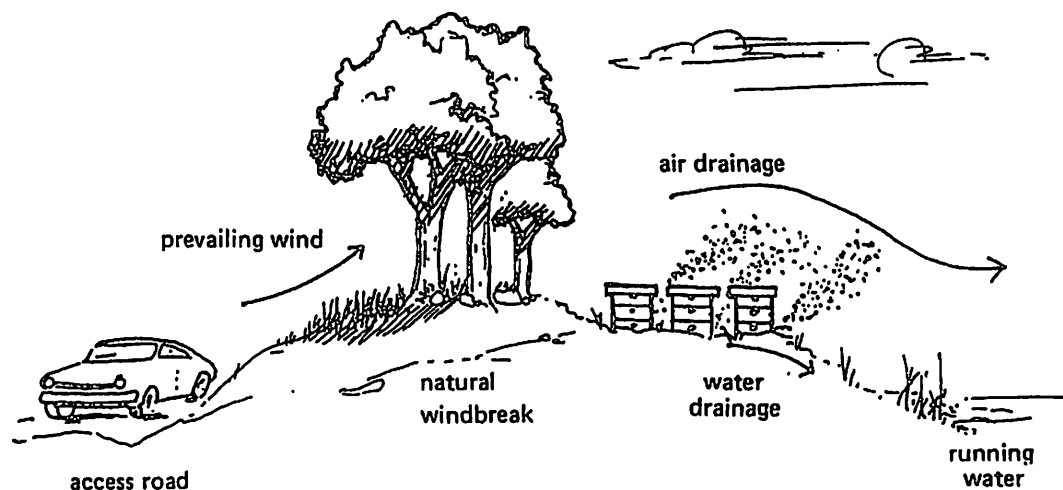
# Before the Bees Arrive

## THE APIARY

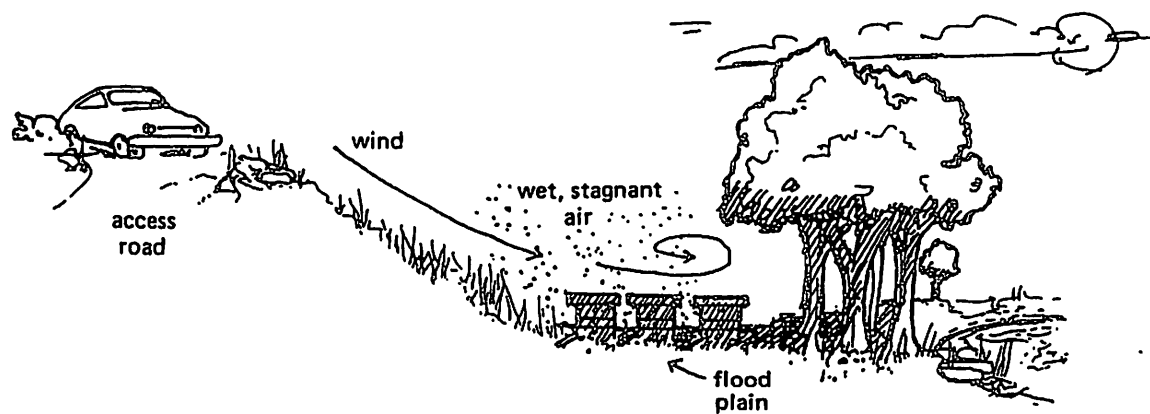
The ideal apiary or bee yard should be located to optimize the following conditions:

- close to fresh water; this can be supplied with a dripping faucet or other device
- easy year-round vehicle access
- near food sources, especially waste areas and marsh land
- on top of slopes to improve air drainage away from hives
- away from wet bottomland and stagnant air; honey will not cure properly if too wet
- in open fields with north windbreak and noontime summer shade
- far from fire and flood areas
- near the owner or friendly neighbors to discourage vandals and thieves and to encourage visits
- with entrances oriented to the east southeast to catch sun's early warmth and to keep out prevailing winter winds
- with entrances clear of weeds and other obstructions

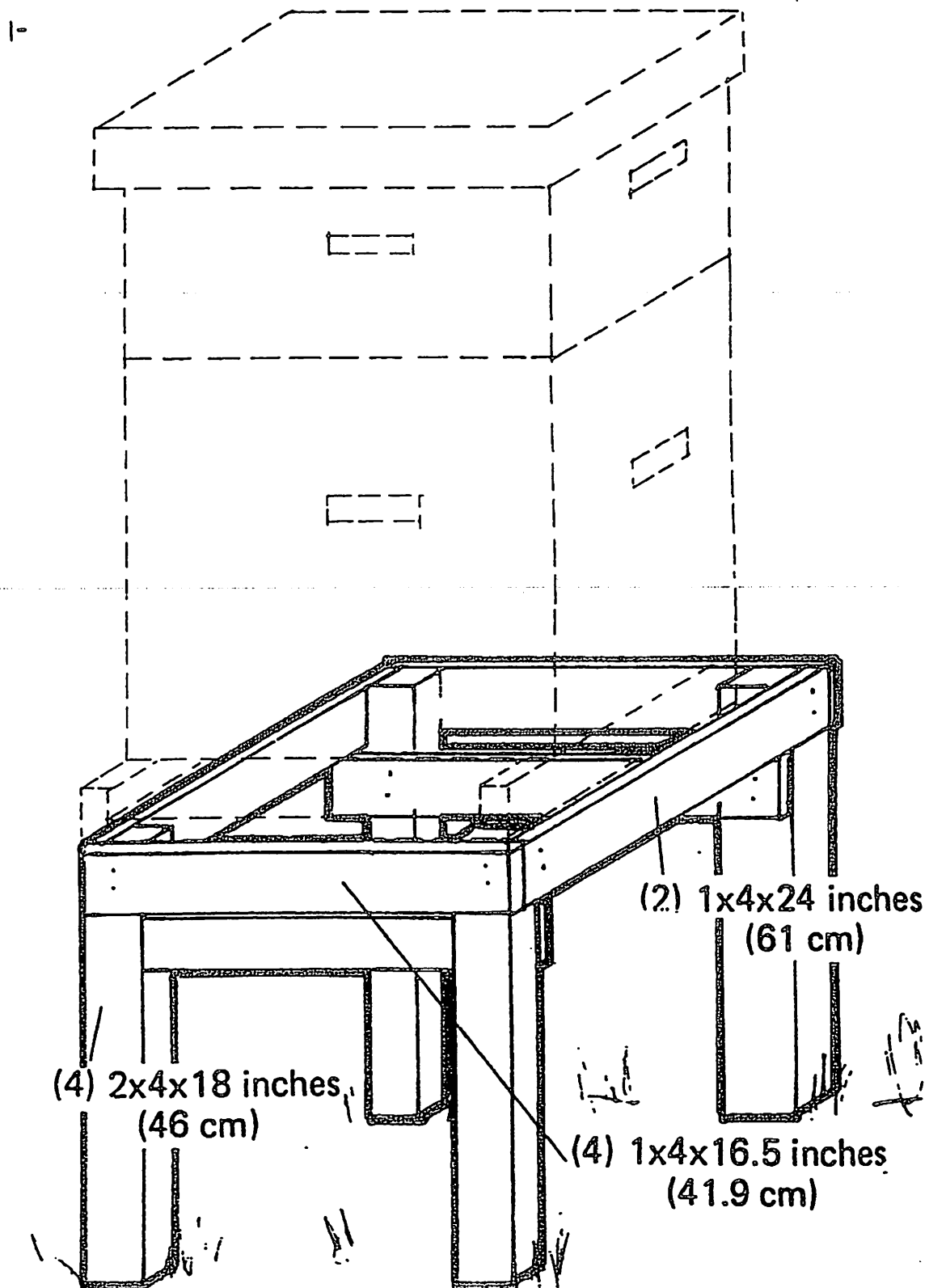
## Ideal Site



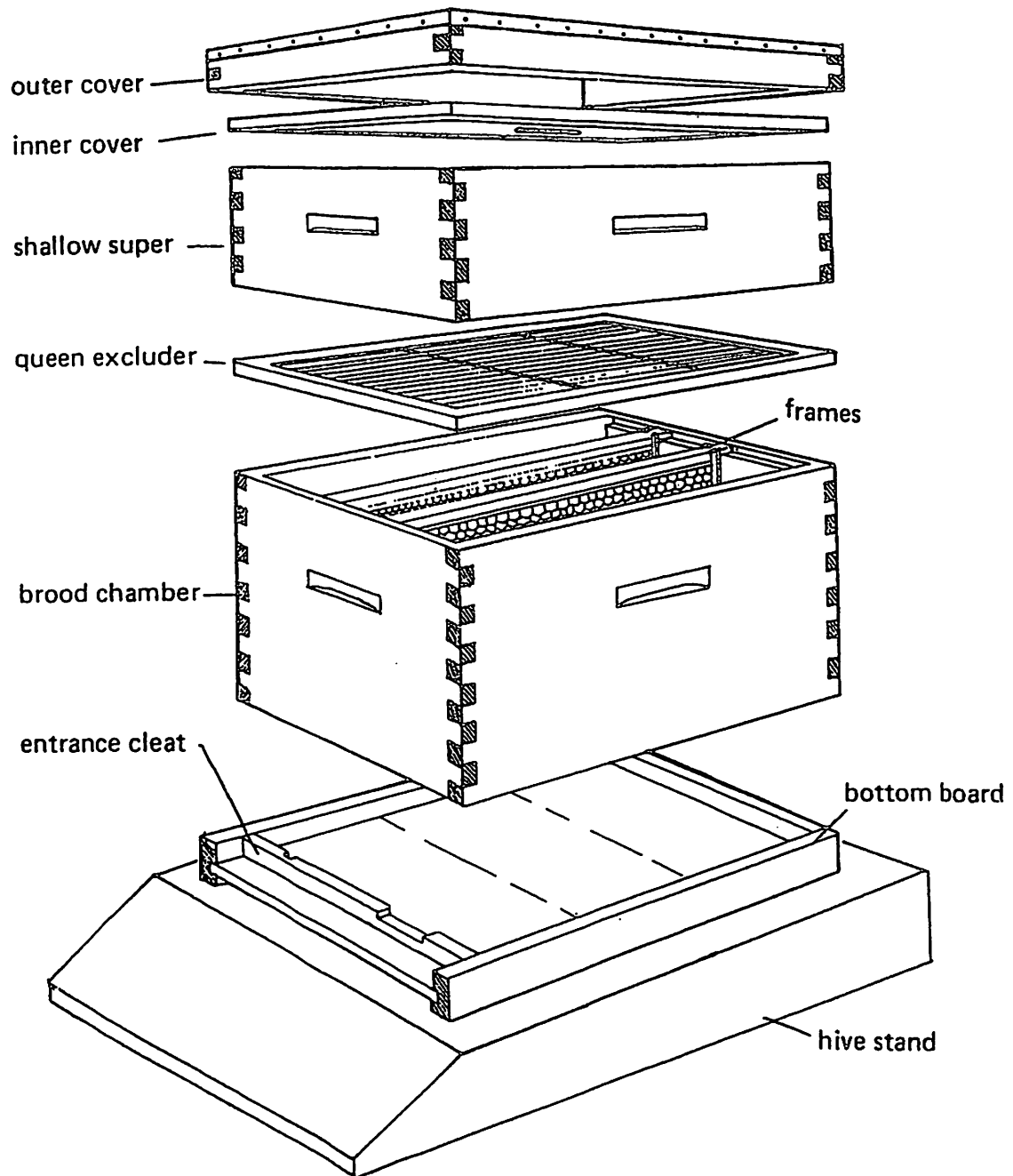
## Poor Site



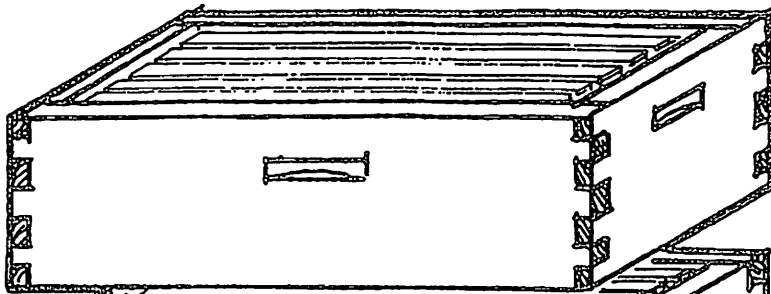
# High Hive Stand



## Basic Hive Parts



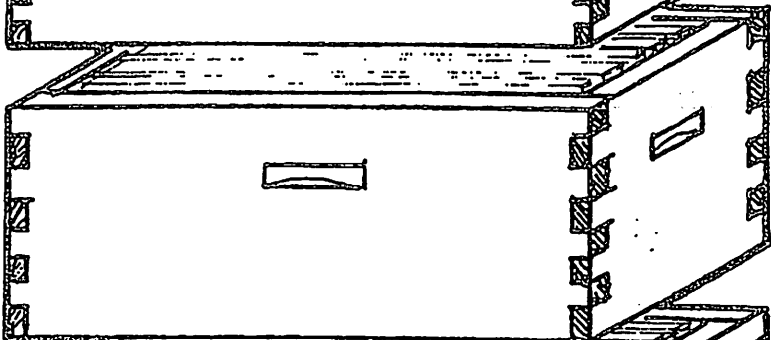
## Sizes of Supers



shallow

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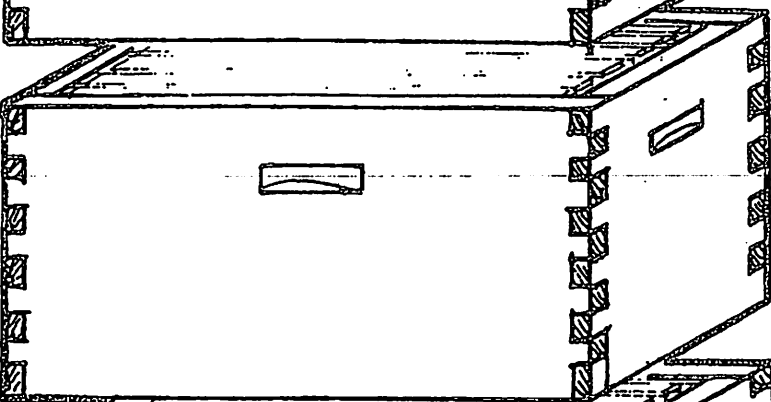
full weight 25 lbs (11.3 kg)



half depth

5 11/16" (14.4 cm)

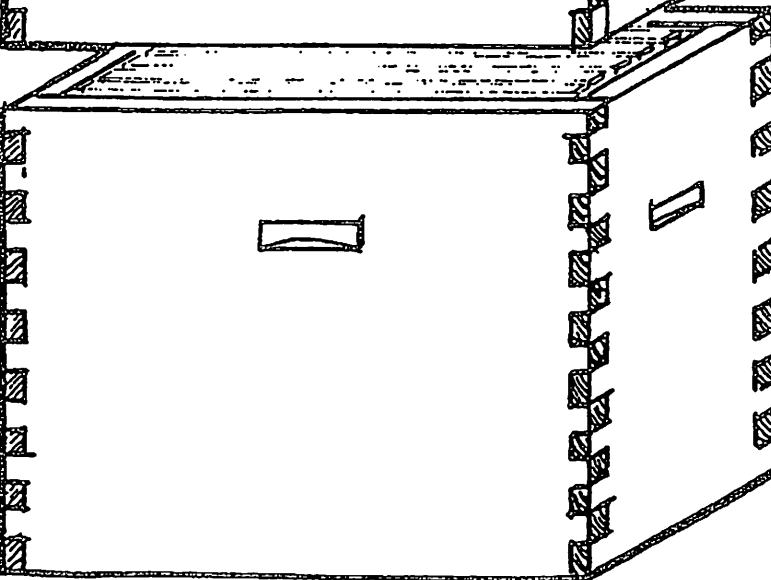
full weight 35 lbs (15.8 kg)



three-quarters depth

6 5/8" (16.8 cm)

full weight 65 lbs (29.3 kg)



full depth

9 5/8" (24.5 cm)

full weight 90 lbs (40.5 kg)

### **III**

#### **Apiary Expansion**

##### **Evaluation of apiary location**

There are several ways beekeepers can increase the number of their hives. But before such "increase" is attempted, consideration should be given to the apiary site for its potential from a beekeeping standpoint, particularly if non-migratory hives are to be kept there.

Preferably, a variety of sources of pollen and nectar should be available in sufficient quantities within a short distance from the hives and this during most of the beekeeping season.

Water must also be available to the bees. This is of particular importance during the hot dry months.

Finally, having easy access to the hives becomes appreciable in view of the larger amount of equipment that will have to be handled.

##### **Purchasing bees and beekeeping equipment**

In planning the expansion of the apiary, a sufficient amount of time should be allowed for equipment and bee procurement and for any construction and finishing that may be necessary.

Prior to its use, older equipment must be cleaned, disinfected, brought to a good state of repair and coatings must be thoroughly cured.

Besides the purchase of established hives or packaged bees, the expansion of an apiary may be achieved through the creation of nucs (nucleus colonies), through the division of established hives and by capturing swarms or feral colonies.

##### **Creating nucs (nucleus colonies)**

Beekeepers may start new colonies by assembling sets of a few frames from strong colonies into correspondingly sized nuc boxes or in hive bodies equipped with follower boards.

Inside each nuc there should be the equivalent of one frame of sealed brood and one frame of eggs and young larvae, along with at least one frame containing honey and pollen. The frame containing the eggs and young larvae is to be placed next to the frame of pollen and honey to ensure that the nurse bees that will tend to them will have direct access to the food they need. The bees adhering to these frames should be supplemented by shaking the bees covering one or two additional frames into the nuc box. It is important to reduce the entrance and to feed with a 1-to-1 sugar syrup.

[illegible]

1. The first step in the process is to identify the problem or issue that needs to be addressed. This involves gathering information and understanding the context of the problem.

2. Once the problem is identified, the next step is to define the objectives and goals of the project. This helps to clarify what needs to be achieved and provides a clear direction for the team.

3. The third step is to develop a plan or strategy to address the problem. This involves breaking down the problem into smaller, manageable tasks and determining the resources needed to complete them.

4. The fourth step is to implement the plan. This involves putting the strategy into action and monitoring progress to ensure that the project is on track.

5. The final step is to evaluate the results of the project. This involves assessing the outcomes against the objectives and goals to determine the effectiveness of the intervention.

[illegible][illegible]

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1. The first step in the process is to identify the problem or issue that needs to be addressed. This involves gathering information and understanding the context of the problem.

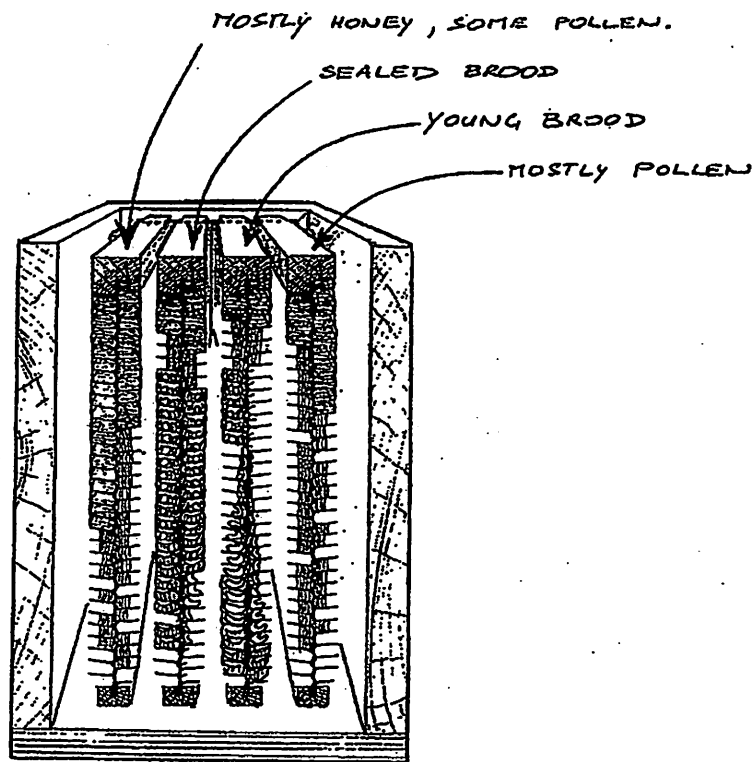
2. Once the problem is identified, the next step is to define the objectives and goals of the project. This helps to clarify what needs to be achieved and provides a clear direction for the team.

3. The third step is to develop a plan or strategy to address the problem. This involves breaking down the problem into smaller, manageable tasks and determining the resources needed to complete them.

4. The fourth step is to implement the plan. This involves putting the strategy into action and monitoring progress to ensure that the project is on track.

5. The final step is to evaluate the results of the project. This involves assessing the outcomes against the objectives and goals and identifying any areas for improvement.





*Section through a four-frame nuc.*

Nucs may be allowed to raise their own queens from the young larvae (see "Queen rearing"). Alternatively, a young, mated queen or a queen cell may be introduced in each nuc.

When the young queen begins laying eggs, the developing colony should be transferred into a larger hive body and given additional frames to allow it to grow. It may be noted that creating the nucleus colony directly in a hive body with follower boards eliminates this transfer and facilitates the addition of frames.

### **Dividing/splitting hives**

By selectively dividing colonies that are headed by good queens, as well as by starting nucs and introducing queens issued from lines that have been bred for desirable traits, beekeepers improve the overall characteristics of their apiaries and those of the local bee genetic pool.

Mention was previously made that, if done early enough in the spring, dividing a hive might be an effective measure of swarm prevention. Regardless, care should be taken not to divide hives so early that they become excessively weakened by the division. Growing the colonies should remain the beekeeper's priority.

The first of these is the fact that the
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1. The first step in the process of the investigation is the identification of the problem. This is done by the investigator who is responsible for the study. The investigator must first identify the problem that is being studied. This is done by the investigator who is responsible for the study. The investigator must first identify the problem that is being studied. This is done by the investigator who is responsible for the study.

## FOURTEEN

# Stings

A beekeeper worth the name develops a healthy contempt for stings. Indeed, he really should start out with that attitude before he has received his first one, so that this aspect of his craft can always be kept in proper perspective. Over the course of years I have woven a veritable philosophy around my attitude of sublime indifference to stings. I have needed the fortification of this philosophy, for a sting does still hurt, just as much, I think, as when I was a novice beekeeper. And it still brings from my lips the same sputtered oaths. In spite of this, I have to maintain a genuine and stoical lack of concern for them. I have to really believe, when I am working with the bees, that I am *not* going to be stung. This is the central requirement for the demeanor necessary in the presence of bees. I have to believe this even though I know, if I pause to think about it, that it is the exception rather than the rule if I conclude my work in a yard with no stings.

Bee work requires intense concentration. One has to keep one's mind on the task at hand, without distraction. Otherwise, blunders are made and the bees might, in fact, become antagonized, so that instead of facing the possibility of a sting or two one is suddenly met with the threat of hundreds of them. You can avoid such a sudden turn of events by keeping your

mind on what you are doing. Success in dealing with bees demands a certain demeanor. What is called for is efficient and deliberate movement. It is not so much *slow* motion that is wanted but a controlled approach. Such control is a difficult thing to describe, or even to demonstrate, but nothing destroys it more quickly than anxiety and fretfulness. The moment you jump in alarm you abandon the temperament essential to beekeeping. Some people possess that temperament by birth, as a part of their nature. They somehow sense exactly what is called for and the bees do, in fact, tend to keep their peace with them. Others, although they may have kept bees for years, never develop a deliberate approach, and their hours in the bee yards are hectic and disorganized. Stings are their appropriate reward. These persons should never have taken up the craft, and few of this kind ever do. They belong in the wrestling ring rather than in the apiary.

The best description of the demeanor needed for beekeeping was conveyed to me years ago quite by accident. A sweet and saintly woman came upon me as I was working with some hives, and she was impressed by my bare hands and shirtsleeves. After watching from a safe distance for a while she remarked: "You just send love out to them, don't you?" That is it exactly. It is not just a matter of loving bees; I suppose every beekeeper loves bees in some sense or other. It is more a thing of spirit or attitude. However absurd it may sound to those of scientific orientation, a good beekeeper sends love out to the bees, without giving it any particular thought. In that frame of mind, the work goes well, smoothly, efficiently, without upsets and, in fact, usually without many stings.

Despite what most people believe, bees are not prone to sting. Cross bees are the exception, gentle bees the rule. Most

wild things are gentle, and bees are too. They are among the gentlest things on earth, far superior to men in this respect. They have their own purpose, as all things do, and it is not to sting. They must be provoked into it. A beekeeper who stands in the midst of his apiary, perhaps clad in nothing but shorts and sandals as thousands of bees fill the air around him, is not



being courageous. His mere presence is no signal to the bees to attack. For years I kept a dozen hives on my garage roof in the heart of a city, with neighbors and children on every side, and there was never a single complaint of a sting. I was finally obliged to move them, not because anyone was stung, but because a new neighbor moved in down the street, and, noticing beehives, became alarmed at the thought of stings and complained. At that point, upon moving the bees, I moved myself as well; for although I loved my house, I loved my bees more.

The bee was given her sting for the defense of the colony and nothing else. Hence, bees attack almost entirely in proximity to

the hive; elsewhere they can be goaded to sting only by extreme measures, such as being stepped on with a bare foot.

The same is true of hornets and wasps. The sting is a defense mechanism. Nature is indifferent to the loss of this or that individual insect and makes no provision for its survival, but the destruction of the colony threatens the species itself. It is there that the life of the species is carried forward. Of course, virtually every sting received by a member of the general populace, whether in proximity to a beehive or not, is called a *bee* sting, so bees, innocent of any involvement in 90 percent of such incidents, nevertheless suffer condemnation for them all. There is hardly a large lawn or meadow that does not harbor yellow jackets, which go peacefully along unnoticed, their nest concealed in the ground, until someone disturbs it. Then the report is spread of a vicious stinging by "bees," and the incident is likely to be so reported in the local newspaper if it is serious. Proper identification is rarely made. I have even seen large paper hornet nests referred to as "beehives," and more than once I have been summoned, in my capacity as beekeeper, to come deal with them.

It is in this manner, too, that bees have acquired the reputation of being more dangerous than rattle snakes, a comparison I have seen solemnly reported in newspapers. More persons, it has been discovered, die from insect stings than from snakebites. This is, in fact, true, because a minuscule part of the general population is hypersensitive to insect stings. For these few, a sting is a real threat to life. Despite precautions, these people are likely to receive a sting sooner or later. The likelihood of a given individual ever suffering a snakebite, on the other hand, is relatively small. Rather few people ever see a poisonous snake, much less receive a bite from one. These basic facts are then

modified into the falsehood that more people die each year from bee stings than from snakebites. This, in turn, becomes the outrageous general statement that bees are more dangerous than rattle snakes, which makes splendid newspaper copy.

The misconception might be harmless enough if it did not also separate vast numbers of people from an appreciation of the most beautiful aspects of nature, not to mention the strange reputation it imparts to beekeepers. It does sometimes make life difficult. I have already mentioned my having to move the apiary from my garage roof, not as a result of mischief done, but simply mischief ignorantly feared. The same kind of fear nearly cost me my best apiary site. I found what seemed to me a very promising place to set up a yard and approached the farmhouse a quarter of a mile away to seek permission. The farmer assented at once, but his wife was alarmed at the thought of bees visiting her garden. My reassurance that bees, after all, fly for miles only alarmed her more. She evidently thought they would fly such distances only to seek her out and attack her in her garden. It is pathetic that such wedges of fear and ignorance should be driven between people and nature, for we shall always be part of that nature, whether we understand her or not.

A beekeeper soon learns that bees are subject to swings of mood and temperament just as people are, and generally from the same basic causes. This is no projection of human feelings into other animals. It is one of the most obvious facts of apiculture. The general formula is very simple. When all is going well and the bees are able to satisfy their ends, they are agreeable, but when their efforts are frustrated, they become cross. A beekeeper can work with his bees in his shirtsleeves on a warm spring day when the life of the colony is expanding and acres upon acres of flowers are quite suddenly opening, offering

pollen and nectar in greater abundance than the bees can take advantage of. Hives can be taken apart, combs removed for inspection and the bottom boards cleaned with only the slightest notice from the happy and industrious bees. Sometimes on such a day even the veil can be discarded with little risk.

When, on the other hand, the sources of nectar have dried up, as is likely in August, and the bees sense a threat to their well-being, they respond angrily to the slightest disturbance to their hives. Again, when the beekeeper has harvested honey, leaving little on the hives, the bees are sometimes reduced to a very ugly mood until more nectar is gathered and the threat of starvation is banished. Their mood swings from one extreme to another even in a single day. Many beekeepers have wondered, for example, why the hives are so cross when buckwheat is in bloom. In fact, they are not then cross in the morning; only in the afternoon. The explanation lies in a peculiarity of buckwheat itself: It secretes nectar only in the mornings.

A beekeeper, knowing the signs of these swings of temperament, is often credited with great courage when no credit is due. Swarming bees, for example, are notoriously gentle, at least for the first day or so. They have abandoned their hive, therefore have no hive to protect and no inducement to sting. So some beekeepers do not even bother with a veil when they deal with a swarm. This always makes a stunning impression upon onlookers, and I have awed many audiences this way.

And of course I always have beehives near my house. I would not want to live where I could not. It is one of my pleasures to present visitors with a comb just taken from a hive and covered with hundreds of bees, among which they are invited to pick out the queen. The bees have no reason to fly from the comb and sting, and virtually all of them are young nurse bees anyway,

but this performance is invariably met with stiffened expressions on the faces of my guests. If people will not open their eyes to the wonders and loveliness of nature, if they insist upon closing them in fear and distrust, then I feel that I must, when I can, force their eyes open. I feel like Plato's philosopher, entering the dark caves of ignorance in which people immerse themselves and dragging them into the sunlight.

It was discovered in antiquity that smoke instantly mollifies the mounting anger of bees, transforming them from a bold and threatening army into a passive and retreating throng. This is a very useful fact of their psychology. A beekeeper would usually be helpless without his bee smoker. A gentle puff or two gives him complete control of the situation under almost any circumstances. No one seems to know why this is so, and I am often asked what the smoke "does" to the bees. I am convinced it does nothing to them, in any ordinary sense. Certainly, it does not harm them in any way. My view is that they react to smoke in exactly the way we do—they turn away from it. Their defense is, in any case, an appropriate one, for they do what would be the best thing to do if threatened by a forest fire. They turn their attention to their stored honey and make ready to salvage that, at least, in case all else should go up in flames.

It is a widespread belief among beekeepers, even among those who have studied bees for years, that upon sensing smoke the bees all gorge themselves with honey. Sometimes this is even offered as the explanation for their gentleness in the presence of smoke—that they are so filled with honey they can no longer bend their bodies in the manner necessary for implanting a sting! Which only shows that there is probably nothing too absurd to be believed by someone, even sometimes by experts. When a puff of smoke wafts over an open hive one can,

indeed, see bees soon drawing honey from open cells, but only a minute fraction of the total population is so engaged. The rest go about their activity much as before. Certainly the hive as a whole does not "gorge" itself, and authorities who have suggested this have substituted imagination for vision. A bee filled with honey, is, moreover, still perfectly capable of stinging. She has simply lost the inclination.

There are varieties of stingless bees, but they are not of much interest because they gather no significant quantities of honey. And I am, on the whole, glad that our honeybees do sting. I find something to admire in the way they can bear down on an intruder, even when I am the intruder. Beehives in gardens would probably be as common as tomato vines if their occupants did not sting, and while this would be nice, in a way, it would also rob the beekeeper of that specialness that I, at least, prize. And it would, it seems to me, be an imbalance in nature if anything as delicious as honey were obtainable with little effort. As things are, the bees hold their own against the virtually omnipotent human species, and I am glad it is so.