

5. HONEY HUNTING AND BEEKEEPING

Humans have devised many different ways to exploit bees for their honey and other products. Considering the wide range of bee practices still existing world wide and which can be categorized into three working definitions: honey hunting, beekeeping and a third category, named here as ‘bee maintaining’ which falls somewhere between honey hunting and beekeeping – where the beekeeper provides a nest site, or protects a colony of wild bees for subsequent plundering. Table 5 below shows these three types of apicultural activity and the types of bees that are being exploited by them.

TABLE 5
Types of apicultural activity and the bees that are exploited

Activity	Genus	Species
Honey hunting	Honeybees	All honeybee species: <i>Apis andreniformis</i> <i>Apis cerana</i> <i>Apis dorsata</i> <i>Apis florea</i> <i>Apis koschevnikovii</i> <i>Apis laboriosa</i> <i>Apis mellifera</i> <i>Apis nigrocincta</i> <i>Apis nuluensis</i>
	Stingless bees	Many species
‘Bee maintaining’ (guarding a wild nesting colony)	Honeybees	<i>Apis florea</i> (in Oman) <i>Apis dorsata</i> (rafter beekeeping in South East Asia, ‘bee trees’ in Malaysia, and many other examples) <i>Apis laboriosa</i> (cliffs in Bhutan) <i>Apis mellifera</i> (Africa) And many other examples....
	Stingless bees	Many species
Beekeeping (keeping bees inside a hive)	Honeybees	Cavity nesting species: <i>Apis cerana</i> <i>Apis koschevnikovii</i> <i>Apis nigrocincta</i> <i>Apis nuluensis</i> <i>Apis mellifera</i>
	Stingless bees	Many species

This Chapter will discuss the various ways of exploiting honeybees. Chapter 6 will look at ways of exploiting stingless bees (Part 2).

HONEY HUNTING OF HONEYBEES

Honey hunting – plundering wild nests of honeybees to obtain crops of honey and beeswax – is still widely practised where people are poor and living at subsistence level and wild honeybee colonies are still abundant. Honey hunting may be seen as part of the lives of the world’s remaining hunter-gatherers, often at the margin of the farming world. The colonies of honeybees are nesting in the wild and, depending on species, may be nesting in tree cavities, in trees, or rocks, termite mounds or underground. Where bees are plentiful, honey hunting may be practised widely. Sometimes wild honeybee colonies are regarded like the ‘hole in the wall’ automated cash machines of industrialized countries. When a family or individual needs some cash – a quick way to obtain it can be by honey hunting – plundering a known colony for some honey and quickly gaining some cash or ‘barter value’ in this way. The products from honey hunting may be indistinguishable from the products from beekeeping in hives.

Positive aspect

- For hunter-gatherers, honey hunting is a way of quickly obtaining high carbohydrate (honey) and high protein (pollen and bee larvae) foods with no financial cost. When a buyer is available, honey hunting is often seen by very poor people as a quick way to raise cash.

Negative aspects

- Honey hunting kills bees.
- It may now for some bee species and in some areas represent a non-sustainable depletion of honeybee colonies and habitat.
- Honey hunters may cause forest fires.

Honey hunting in Asia

In Asia, large volumes of honey are still obtained by plundering wild colonies of honeybees. This is because some of the Asian honeybee species exist only in the wild, and cannot be kept inside man-made hives. Honey hunting of *Apis laboriosa*, a honeybee species that nests at high altitudes, is practised in the Hindu Kush Himalaya region. Honey hunting of *Apis dorsata* is practised throughout its distribution range: from Pakistan in the West to the Philippines in the East. Honey hunting of cavity nesting *Apis cerana*, *Apis koschevnikovii*, *Apis nuluensis* and *Apis nigrocincta*, and the 'little' honeybee species *Apis florea* and *Apis andreniformis* is practised wherever they occur.

The large Asian honeybee species, *Apis laboriosa* and *Apis dorsata* often nest high on cliffs or in high trees. However, the combs are very large and yields of honey are worthwhile. Honey hunting is therefore a dangerous, although worthwhile activity in many regions of Asia. Local customs and traditions have become associated with honey hunting, and have been studied by anthropologists and social scientists: this means that traditional honey hunting and cultural associations have been well documented in some areas. Indeed, in Nepal and Malaysia tourism based on viewing traditional honey hunting spectacles has taken off. Details of publications, videos and CD's detailing honey-hunting traditions are shown in Further Reading in Chapter 15.

Honey hunting outside Asia

Honey hunting of indigenous *Apis mellifera* colonies is commonly practised in Africa, and of feral *Apis mellifera* colonies in Central and South America, wherever colonies are abundant – most often in forested areas.

BOX 6**The African honey guide**

Honey guides are African, woodland birds belonging to the genus *Indicator*. They are remarkable for having evolved the behaviour of apparently leading honey hunters (as well as honey badgers and other bee predators) towards bee nests. There are several different species of honey guide, the most common being the greater honey guide *Indicator indicator*, and the lesser honey guide *Indicator minor*.

Honey hunters whistle to locate the honey guides. The birds then chatter continuously and flutter conspicuously, gradually leading the honey hunters towards the vicinity of a bees' nest, when they become quiet. When the honey hunters plunder the nest, the honey guides are rewarded with feeding from the bees' nest: brood, pollen and honey. Another unusual feature of these birds is their apparent ability to digest beeswax.

SHOULD HONEY HUNTING BE ENCOURAGED?

Witnessing honey hunting is to see large numbers of bees killed with burning brands and colonies destroyed. There is no data available on the population sizes of Asian honeybee species: indeed beekeeping texts written before 1990 list only three Asian species – *Apis cerana*, *Apis dorsata* and *Apis florea*; five additional species have been described since then! We do not know the impact of honey hunting upon these populations: supporting, for example, the hunting of the Himalayan honeybee (*Apis laboriosa*) may indeed be the bee equivalent of hunting tigers.

Efforts have been made to encourage honey hunters to harvest without destroying the whole colony: i.e. to harvest only comb containing honey and leave comb-containing brood intact. However, this is easier to discuss in the classroom than it is to achieve in practice. Certainly traditional honey hunting practises in some areas have involved rules to ensure that bee populations were sustained. We do not know the effect of decreasing tree habitat and increasing human population pressure on honeybee populations. In many areas, honey hunting has increased with increasing human population, and this combined with a loss of large trees for nesting of bees. The loss of large trees makes it more difficult for bees to find secure nesting places: when they nest in smaller trees, they are easier to locate and to plunder. Certainly, in the Gambia and Senegal, honey hunting has led to a lack of bees, and with possible bad effect upon pollination and biodiversity maintenance, just as the need for these increases.

THE PRODUCTS OF HONEY HUNTING

Because honey hunting usually takes place under difficult circumstances (swinging from a rope on a cliff face, high in trees at night time), the product from honey hunting is usually a mixture of ripe and unripe (i.e. high water content) honey, beeswax, dead bees and other debris. However, this is not to say the product is of low value: often it will ferment quickly but has high local value as a cultural food, tonic, aphrodisiac or medicine. In Africa, honey from honey hunting is most often made into honey beer. In this case, the various impurities help it to ferment all the faster. However, not all honey ends up this way, certainly for example in India, large volumes of honey are harvested from *Apis dorsata* colonies, and this honey reaches the domestic honey market. There are no statistics available on the volumes of honey harvested from wild bees.

PROVIDING SUPPORT TO HONEY HUNTERS

People from honey hunting regions who receive formal training in beekeeping tend sometimes to become quickly indoctrinated into the belief that honey hunters are not beekeepers and somehow outside the beekeeping community. This has meant that extension services in many developing countries often assist only beekeepers and completely ignore honey hunters. This can also be because beekeepers are more accessible than honey hunters who may be found among the poorest and most remote rural people. People who practise honey hunting, as mentioned above, may be seen as hunter-gatherers and tend to be poor, self-effacing and invisible to mainstream extension efforts. Many textbooks completely fail to mention the existence of honey hunters, although in many Asian countries the majority of honey on the local market may be obtained from honey hunting.

If it is decided that honey hunting is sustainable and if honey hunters want support, they can be assisted to harvest honey that is of better quality, by reducing contamination during and after harvest and especially by providing clean, lidded containers in which to store the products. Assistance with marketing is often the best assistance that can be provided. Honey hunters usually discard beeswax, but they can gain from training in how to harvest, render and market beeswax.

BEE-MAINTAINING

Harvesting of a bee colony nesting in a tree would be described as honey hunting. The piece of tree cut and, containing the bees, and placed conveniently near the human's home, would be described as beekeeping (the tree has become a log hive). However, there is an intermediary stage where the beekeeper may have ownership of the bees and/or the tree and protects them in some way – from other honey hunters, or other predators. This intermediary stage occurs in many situations. For example, for *Apis mellifera* colonies in Sudan and other African countries, beekeepers can have ownership over colonies in specific trees or rocks. The same is true in Asia, of individuals or communities having ownership over bee trees or bee cliffs. In the past, this type of 'bee tending' was widespread. Traditions from Africa, the Mediterranean region, Persia, Europe and Asia have been documented by Crane (1999).

Honey from the little honeybee *Apis florea* is particularly highly prized in Oman, being sold for over \$US100 per kilogram. *Apis florea* builds a single comb and cannot be kept inside a hive, but in Pakistan and Oman, beekeepers 'manage' *Apis florea* colonies by maintaining them in small shelters (Dutton, 1982).

In the *Melaleuca* forests of Vietnam, beekeepers provide artificial nesting places for *Apis dorsata*: this makes harvesting of the combs convenient and easy: see Case Study 3 (at the end of this chapter) on rafter beekeeping.

These are all examples where the beekeeper provides some care for the colony, but the colony is still living life entirely as it would in the wild. Other examples of keeping *Apis dorsata* on rafters have been described from Cambodia (Jump and Waring, 2004), Indonesia (see Case Study 2 on *Traditional honey and wax collection from Apis dorsata in West Kalimantan*), Malaysia, and the Andaman Islands, India.

BEEKEEPING

For thousands of years it has been known that obtaining a honey crop is made much easier and more convenient than honey hunting if bees are encouraged to nest inside a man-made hive. The hive makes ownership of the colony very clear, it can be kept near to home, and harvesting the honey is easier. Depending on the type of hive, and the species and race of bees, it is also possible to manage the colony to some extent. This is beekeeping – although the term beekeeping tends to be used colloquially to describe all activities involving bees, including the subsequent harvesting, and processing of their products.

There are many different routes to successful beekeeping that suit different situations. At one extreme is the placement of an empty hive and at some future point if it has been colonised by bees, cropping of honey – with no other interference by the beekeeper. At the other end of the scale is beekeeping involving expensive hives, the provision of selectively bred or instrumentally inseminated queens, sophisticated monitoring and control of honeybee diseases (now essential in many regions), the movement by the beekeeper of the bees to different crops as they come into flower, mechanical harvesting and processing of honey, and much else.

THE SELECTION OF EQUIPMENT

In selecting equipment, the following factors should be considered:

- If beekeeping is being promoted as a sideline activity then it must be wholly sustainable, using equipment, which is available locally. Although equipment can be imported to serve as a prototype, small-scale beekeeping can only be economical in the long-term with equipment, which can be serviced and manufactured locally. The equipment needed for honey hunting, traditional and low technology beekeeping can usually be made at village level.
- Honeybee species and races vary in size. A honeybee nest (of those species that can be kept inside hives) consists of a series of parallel beeswax combs. Each comb contains rows of wax: hexagonal compartments containing honey stores, pollen or developing bee larvae (brood). The combs are evenly spaced and are attached to the ceiling of the nest. This spacing, known as the 'bee-space', is critical in maintaining optimal conditions within the nest with just enough space for the bees to walk and work on the surface of the combs, while maintaining the optimum nest temperature. Bee-space, dimensions of combs and nest volume all vary with race and species of honeybee. The bee-space is a critical factor in the use of bee equipment and honeybees cannot be managed efficiently using equipment of inappropriate size. When buying equipment it is important to have an understanding of the honeybees to be housed and the specification of the equipment offered. Most equipment is manufactured to the specification for bees of European origin.
- Honeybee species and races vary in biology and behaviour. Strategies for the management of honeybees have been developed mainly for temperate-zone races of honeybees and most movable-frame equipment is intended for this type of management.
- Colonies of tropical honeybees show a tendency to abandon their hive – this may be due to either seasonal migration or absconding because of disturbance by predators, and no reliable management techniques have yet been developed to prevent these – apart from feeding bees to ensure they do not abscond for lack of food, and to prevent disturbance by predators as far as possible.

- During the last three decades, there has been a tremendous increase in the spread of bee diseases and predators around the world. This has been brought about by man's movement of honeybee stocks. There are still a few remaining regions without introduced honeybee diseases and parasites, and most of these are in developing countries. It will be in the future benefit of these countries if they can retain their stocks of disease-free honeybees. It is therefore essential to ensure that used beekeeping equipment is not imported. Honeybee colonies or even single queen bees must never be moved from one area to another without expert consideration of the consequences.
- It can be helpful to import basic equipment (protective clothing, smokers, hive tools, etc.) to serve as prototypes for local manufacture.
- For beekeepers practising on a larger scale, for example where a co-operative has established a honey packing unit there are often items which necessitate importation, for example honey gates (effective honey 'taps' for use on honey containers), specialized gauzes for the filtration of honey, or the equipment for determining honey quality.

CHOICE OF HIVE TYPE

A hive is just a container to keep bees inside, and good, serviceable hives can be made from many different materials. The purpose of a hive is to encourage the bees to build their nests in such a way that it is easy for the beekeeper to manage and maintain them. Different styles of hive may be of greater or lesser convenience for the beekeeper, but the honeybee is only concerned to have a safe place, large enough for the whole colony (the bees' family) and its stores, and protected from unfavourable weather and predators.

The best method for any situation will be determined by the available human skills, physical and financial resources, and the species and race of bee being utilised.

Hive type need not determine honey quality

The type of hive a honeybee lives in has no effect upon the quality of honey that she makes. Honeybees always store clean and perfect honey regardless of where they are living: it is subsequent handling by humans that leads to reduction in quality.

The volume of honey harvested from a colony is decided by the forage for bees that is available in the area, and the strength and needs of the colony. As long as the hive is of large enough volume, bees will store as much honey as they can. (The more honey they can store, the greater the chance of the colony surviving through hard times ahead.) Movable frame hives influence honey production because they save bees' effort in creating beeswax comb: therefore, movable frame hives enable harvests of honey rather than beeswax. This is explained further below in the section of movable frame hives.

BOX 7

The three main types of hive

Fixed comb hives: clay hives, wall hives, log hives, bark hives and many others

Movable comb hives: top-bar hives, of which there are many styles

Movable frame hives: Langstroth, Dadant, Adz, National, Smith, WBC, etc.

Fixed comb hives

These are containers made from whatever materials are locally available: typically, hollowed-out logs, bark formed into a cylinder, clay pots, woven grass or cane. It is common in some countries of Africa, Asia and the Middle East to keep bees inside cavities built into house walls. This keeps bees safe from predators and protected from extremes of heat or cold.

BOX 8**Use of the name 'traditional' for hives**

Fixed comb hives are sometimes named 'traditional hives'. However not all fixed comb hives are of traditional style. Further, there are traditional hives which are not fixed comb hives, but are **movable comb hives**, and the WBC **movable frame hive** (invented over 150 years ago) is by now regarded in some countries as a traditional style hive.

The sole purpose of a hive is to encourage bees to nest in a site that is accessible to the beekeeper. In a fixed comb hive, the bees build their nest inside the container, just as they would build it in a naturally occurring cavity. The bees attach their combs to the inside upper surface of the hive. This means that combs cannot be removed without being broken when the beekeeper harvests the nest to obtain crops of honey and beeswax. Bees may or may not be killed during this process, depending on the care of the beekeeper. If the colony is destroyed, the hive will remain empty for a while. If there are plenty of honeybee colonies in the area then eventually a migrating colony or swarm may settle in the empty hive and start building a new nest.

Beekeepers using local-style hives often own many hives, and expect only a proportion of these to be occupied by bees at any time. In many ways, this style of beekeeping works well for tropical races of honeybees. As described in Chapter 2, the biology of tropical races means that they abscond and migrate. In a tropical country it can be a better strategy for a beekeeper to have a large number of low cost hives, only some of which will be occupied at any time, than to have a small number of high cost hives, some of which may be empty.

The main region of the world where traditional beekeeping practises are still the most widely used – tropical, sub-Saharan Africa – is also the region with least honeybee disease problems. Frequent natural movement of the colony to new nesting sites means that diseases do not have the chance to remain within the colony as they do when colonies are static.

Positive aspects of fixed comb hives:

- May be highly appropriate for the race and species of bees (see above).
- Local people may have knowledge and skills for this type of beekeeping.
- Low financial input costs (usually zero).
- These methods do not spread honeybee diseases, and they maintain healthy honeybee populations.
- Local beekeeping methods provide a source of financial income with no financial input. As one farmer in Uganda put it: "It is the cheapest way to do farming".
- It is possible to harvest first grade, export-quality honey and beeswax from local hives.
- This activity can be entirely sustainable and need not harm bees. Beekeeping does not compete for resources used by any other form of agriculture: unless harvested by bees, the nectar and pollen inside flowers will not be utilised.
- Only a little training, and a few inputs, are needed to upgrade farmers' skills.

Negative aspects of fixed comb hives:

- As with honey hunters, beekeepers are blamed for starting forest fires.
- Less-skilled beekeepers kill the honeybee colony when they harvest from it, making this non-sustainable when combined with habitat loss, and loss of bees by pesticides.
- The great disturbance of the bees' nest may cause the colony to abscond.
- In fixed comb hives, combs may not be built in a way (orientation within the hive) convenient for harvesting by the beekeeper.

- It can be difficult to see when the honey is ready for harvesting – although local beekeepers often are highly skilled in knowing the best time for harvest.
- When harvesting honey, combs near the end of the hive must be removed, and if these happen to contain empty comb, brood, pollen and unripe honey, all of these will be wasted.
- Honey produced by such methods is often (but not necessarily) of poor quality, being contaminated with unripe honey, pollen, brood, wax and dead bees.
- Fixed-comb hives cannot be inspected for disease. On the other hand, beekeepers still using traditional methods often still have disease-free bees! It is the possibility to move frames of bees, and move colonies of bees, which has allowed humans to spread bee honeybee diseases and predators worldwide!

Assistance for fixed comb hive beekeepers

All requirements for this type of beekeeping will be locally available, but beekeepers using fixed comb hives can be assisted by the provision of effective protective clothing, smokers, and most importantly, good containers for harvesting and storing the honey, and also the beeswax. In particular, beekeepers with few resources may benefit from assistance to:

- maintain the quality of the harvested products;
- present products for marketing; and
- access markets.

It is certainly possible to produce top-class honey and beeswax from fixed comb hives. For example, beekeepers in North West Province of Zambia are harvesting high quality honey and beeswax from fixed comb hives made from bark. This honey is organic certified and, because it meets EU market requirements, is exported to the EU (Wainwright, 2002) (see Case Study 10 in Chapter 13).

Movable comb hives

Low-technology hives have been developed as a way of obtaining the advantages of movable frame hives (no need to break combs, standardisation, manageability, efficient honey harvest) without the disadvantage of high cost manufacture. Bees are encouraged to construct their combs from the undersides of a series of top-bars – instead of attaching comb to the ceiling of the hive (as in a fixed-comb hive) or building comb inside a rectangular, wooden frame (as in a frame hive). These top-bars then allow individual combs to be lifted from the hive by the beekeeper. The combs can then be replaced back in the hive, removed for harvest, or maybe moved to another hive or colony.

The container for the hive may, like traditional hives, be constructed from whatever materials are locally available.

Another advantage of this type of equipment is that it opens up beekeeping to new sectors of society: forest beekeeping has traditionally tended to be a male-only activity. Low-technology hives can be kept near home, and can, if constructed and transported with care, be moved between crops as they flower successively (Mangum, 2001).

All equipment for low technology beekeeping needs to be made locally. The only items that need construction with precision are the top-bars. These must provide the same spacing for combs within the hive, as the bees would use in the natural nest. This spacing will depend upon the species and race of honeybees that are being used. As a very general guide, *Apis mellifera* of European origin need top-bars 35 mm wide, and *Apis mellifera* in Africa usually need 32 millimetres. *Apis cerana* in Asia need 30 millimetres. The best way to determine the correct width is to measure the spacing between combs in a wild nest of the same bees. The volume of the brood box should equate roughly with the volume of the cavity occupied by wild-nesting honeybees. Other necessary materials are hive tools, smokers, protective clothing and containers for harvesting, storing, processing and marketing honey.

Main advantages of movable comb hives over fixed comb hives

- The combs can be lifted from the hive and then replaced and this allows the beekeeper to examine the condition of the colony without harming it.
- Honeycombs can be removed from the hive for harvesting without disturbing combs containing brood. The colony is therefore not harmed and the bees can continue gathering honey to replace that which has been harvested.
- Good quality honey can be harvested, free of contaminating pollen or brood.

Main advantages of movable comb hives over movable frame hives

- The top-bar hive is relatively easy to construct, and simpler and cheaper to build than a hive with frames.
- Harvests of both honey and wax are obtained in this type of beekeeping, because the empty comb is not returned to the hive.

Main disadvantages of movable comb hives

- Movable comb hives with top-bars can be more expensive than hives made from hollowed-out logs, etc.
- Combs attached to top-bars must be handled much more carefully than combs built in frames.
- Wax combs cannot be returned to the hive after harvesting.

Some people have experimented with creating extractors for top-bar combs, such that the empty comb can be returned to the hive after harvesting. However, this loses the point of top-bar hives being a simple, low technology and cheap beekeeping option.

Principles for construction of a movable comb top-bar hive

Top-bar hives can be made from whatever cheap or scrap containers are available locally. These could be cardboard boxes, barrels cut in two lengthways, tea chests, or hives made from scrap timber. If timber is being used, it must be properly seasoned, otherwise shrinkage and warping of the hive will occur. The wood must be durable and able to last for several years without replacement, and be suitable for carpentry. The hive must be of a suitable volume: large enough for colonies of bees to build their brood combs and have plenty of room left for building extra combs for storage of honey (it is of course the *inside* measurements of a hive that are important). The hive must be clean and free from any contaminating odours, free of cracks and gaps, and may need some insulation depending upon the climate. Straw or cow-dung is often used as insulation for low-cost hives.

If the hive's top-bars are to be placed next to one another to form a bee-tight top, then each top-bar must be of the correct bee space for the bees to build one comb from each bar (see above). Placing bars next to one another cuts down the number of bees leaving through the top of the hive to disturb the operator, and this can be beneficial when working with highly defensive bees. However, other people recommend using narrower top-bars (that can be cut with less precision) with a plastic sheet placed over the top (Romet, 2004).

Whatever width is used, it must be constant for each top-bar hive in the hive. If top-bars are too narrow, then combs will be too close to one another with no "corridor" for bees to work in – in this case, the bees will fill the gap with comb or propolis. If top-bars are too wide, resulting in too much space between combs, bees will build extra "brace comb" to fill the gap.

It is a skilled job to make top-bars of exactly the correct dimensions using hand tools, and if power equipment is available it is valuable for this operation. The width of the top-bars is the only measurement that must be exact in this type of hive.

After the top-bars have been cut to size, fix a vertical strip of beeswax along the centre of the underside of each bar to guide the bees in building their comb.

In the wild, honeybees build combs that have curved edges and are rounded at the bottom. If the side walls of the hive are rounded or slope at approximately the same angle as natural comb then the bees will not attach their comb to the walls and this allows easy removal of comb. The sides of the hive can therefore be curved or slope inwards towards the bottom to form an angle of 5° with the bottom base. However, this is not essential, and hives with sloping sides are more difficult to construct. In straight-sided hives, bees will sometimes slightly attach the comb to the sidewall of the hive. In this case, it is necessary to gently cut these attachments before the top-bar and its comb may be lifted from the hive.

Movable-frame hives

These are the hives used in industrialized countries and developing countries where beekeeping is an important part of mainstream agriculture and the infrastructure exists to provide specialized expertise and equipment. The objective of movable-frame hive beekeeping is to obtain a maximum honey crop. The possibility of recycling beeswax combs means that the colony can quickly build up honey stores during the flowering season, and may also be managed specifically for the pollination of particular crops.

Rectangular wood or plastic frames are used to support the bees' combs. These frames have two major advantages:

- They allow the beekeeper to inspect and manipulate the colonies (for example moving frames from a strong colony to strengthen a weaker one).
- They allow efficient honey harvesting because the honeycombs within their frames can be emptied of honey and then returned to the hive. This allows increased honey production as the bees' resources are saved from having to build fresh beeswax comb.

Frame hives must be constructed with precision. The spacing between frames must achieve the same spacing as in a natural nest. Frames are contained within boxes and each hive consists of a number of boxes placed on top of one another. Usually the bottom-most box is used as the brood chamber. This means that brood is present only in this box: this is achieved by placing a queen excluder between this box and one above it. The queen excluder is a metal grid with holes of a particular size such that worker bees can pass through but the queen is unable to do so because of her larger size. This ensures that honey alone is stored in boxes above the queen excluder and allows for efficient honey harvest.

In addition to the boxes and frames, a floor and roof are required, along with various other specialized items of equipment.

Frame hive equipment should not be used unless the infrastructure exists for manufacturing it locally. Frame hives require well-seasoned timber, planed and accurately cut, as well as other material like wire, nails and beeswax foundation. They are therefore relatively expensive to make. Frames and boxes must fit together precisely and need accurate carpentry. There must be access to supplies of the parts, which need frequent renewals, particularly foundation and frames. Centrifugal extractors are needed to achieve full potential in harvesting the honey from frame hives.

Main advantages of movable frame hives over movable comb hives

- Standardization of equipment.
- Efficient honey harvest with the possibility to recycle combs.
- The use of separate boxes enables the queen to be confined to particular areas of the hive.
- This type of beekeeping is practised worldwide and most beekeeping techniques and literature relate to this style.

Main disadvantages of movable frame hives

- Frame hives and frames are expensive and intricate and must be built with precision requiring a large amount of timber and nails of different sizes.

- The dimensions of the hive, the frames and their spacing are critical.
- If honey is to be extracted so that combs can be returned empty to the frame hive, expensive equipment is required to extract the honey.
- The continuous re-use of combs can lead to disease build up.
- The continuous re-use of combs can lead to build up of residues used to control bee diseases and predators.
- Beeswax yield is low compared with top-bar hive, and fixed comb hive beekeeping.
- Frame hives placed on the ground are susceptible to tropical pests and predators. Frame hives are not suitable for suspending by wires or hanging in trees (as are fixed comb hives, and to some extent, top-bar hives).

OTHER EQUIPMENT

Smoker

A beekeeper needs a source of cool smoke to calm the bees, and this is achieved by use of a smoker. The smoker consists of a fuel box containing smouldering fuel (dried cow dung, hessian or cardboard) with bellows attached. The beekeeper puffs a little smoke near the entrance of the hive before it is opened, and gently smokes the bees to move them from one part of the hive to another. Imported smokers are useful as prototypes, but smokers can be manufactured by village blacksmiths.

Protective clothing

A broad-brimmed hat with some veiling will serve to protect the head and neck from stings. Adequate protective clothing gives beginner beekeepers confidence, but more experienced beekeepers find that too much protective clothing makes it difficult to work sufficiently gently with the bees, and it is very hot. Some people find that a good way to protect their hands is to put a plastic bag over each hand, secured at the wrist with a rubber band, although this can quickly become very sweaty! Rubber bands prevent bees from crawling up trouser legs or shirtsleeves. Always wear white or light-coloured clothing when working with bees – bees are much more likely to sting dark-coloured clothing. Imported clothing can provide useful prototypes, but modified overalls can be made locally and provides a useful stimulus for local industry.

Hive tools

Apis mellifera honeybees tend to close up every gap and seal every joint in the hive with a sticky substance known as propolis (see Chapter 10). The hive tool is a handy piece of metal which is used to prise boxes apart, scrape off odd bits of beeswax, separate frame-ends from the supports, and so on. It is possible to use an old knife for this job, but knife blades tend to be too flexible and give insufficient leverage. Village blacksmiths should be able to produce a suitable implement and once again, an imported hive tool could serve as a prototype.

BEEKEEPING: MAKING A START

Choosing a place

When choosing a site for keeping bees you must make sure that:

- There are plenty of flowering plants and trees in the area.
- There are no serious environmental problems nearby, such as crops being sprayed with pesticide, etc.
- There is a source of water nearby.
- Hives are sheltered from wind.
- Hives are shaded from strong sunlight.
- Hives are placed out of sight and not near places where humans are likely to be: this is to avoid possibilities of people being stung if the bees are defensive, and to avoid theft.
- Hives are not going to suffer from water dripping from overhead branches.

If you plan to create an apiary, do not site it too near other large apiaries. Start with a maximum of 10 colonies in an area and then gradually find out how many colonies that area can support.

Shade for bees

Honeybee colonies must not get too hot. If the colony temperature becomes too high then foragers will be busy collecting water, to reduce the nest temperature, rather than nectar or pollen. In very sunny conditions, colonies protected by solid shade can produce 50 percent more honey than colonies exposed to the sun. Beekeepers obtain greater honey harvests by providing nearby water sources and protecting colonies from too much heat.

In hot climates, wild-nesting colonies always choose a shady spot for their nest, near to a water supply. The easiest way to protect colonies from the sun is to place them under shade trees in a green grassy area. If no shade trees are available then artificial shades must be constructed. The roof of the shade should be high enough to allow the beekeeper to work amongst the hives. If a large number of hives are to be shaded and a long shade is to be constructed, then it should run east-west to give maximum benefit. In very sunny situations, colonies receive heat radiating from the ground. Reduce this effect by placing the hives on vegetation, or placing mats under the hives. Hives can also be painted white or a light colour to reflect rather than absorb heat.

Hive stands

Hives are best raised off the ground to protect them from various predators. Often old tyres are used as 'hive stands'. However, the higher a hive is raised, the easier it is for the beekeeper to work with. 'Living hive stands' can be very good: this is where the supporting timber takes root and eventually provides a non-rotting stand, providing shade and a good environment for the bees. If wooden stands are used, then in many countries it is essential for the base to stand in a container of oil or water, to prevent ants from entering the hive.

In east Africa, honey badgers are a serious predator of bee colonies, and they can be deterred by hanging fixed comb hives, or top-bar hives from wires:

Hanging a fixed comb or movable comb hive

1. Use strong posts of at least 13 centimetre diameter to hang the hive. Posts that have been treated with wood preservative last longer.
2. The hive should be hung at approximately waist level to the beekeeper for ease of working.
3. Hives should ideally be placed at least two metres away from one another so that one hive can be inspected without disturbing its neighbours.

Obtaining bees

The best way of getting started in beekeeping is with the assistance of a practising, local beekeeper, who will have advice and experience of local bees and conditions that no textbook can provide.

A good way to obtain bees is by transferring a colony from the wild into a hive. The wild colony will already have a number of combs and these can be carefully tied on to the top-bars of a hive. Another way to get started is to set up a hive, perhaps rubbed inside with some beeswax to give it an attractive scent, and wait for a passing swarm of bees to occupy it: this will only be successful in areas where there are still plenty of honeybee colonies.

MANAGEMENT OF HONEYBEE COLONIES

There are many basic texts giving advice on the management of bees, but most of these relate to frame hive beekeeping using honeybees of European origin. Publications on tropical beekeeping are not widely available, but a few are obtainable from specialist suppliers like *Bees for Development*.

Basic tips for working with bees

- Never stand in front of the hive entrance, or in the bees' flight path.
- Choose the right time of day to work with bees to cause least distress to bees (local beekeepers can advise you best).
- Work quietly and calmly. Do not knock the hive, and always try to disturb the bees as little as possible.
- Wear a bee veil to protect your face from stings.
- Avoid using strong smelling perfume, soap or shampoo. Bees in India do not like the scent of 'Head 'n' shoulders' shampoo!
- Avoid crushing and killing bees (squashing them with equipment, standing on them, burning them with the smoker). Apart from reducing the colony strength, each dead bee emits an odour (pheromone) that encourages the other bees to defend the colony, and squashed bees increase the chances of spreading diseases such as *Nosema*.
- Use cool smoke to calm the bees (see below).
- Always remove the lid slowly and carefully. Puff smoke gently at the entrance and anywhere else where bees are leaving the hive. Do not apply the smoker too near to the bees or you may burn them and this will cause them to become aggressive.
- Always leave enough resources (honey and pollen stores) for the bees.
- Do not inspect the bees too often: every time you open the colony, it creates work for the bees and stress, and reduces the amount of honey stored.

Working with top-bar hives

- Remove a few empty top-bars from one end of the hive – this will provide space for working in. Bees at the other end of the hive should not be disturbed by this and will stay calm.
- If a top-bar has been stuck down by the bees with propolis (only with *Apis mellifera* honeybees), gently loosen the top-bar free using your hive tool or knife.
- Continuing from the gap at one end, inspect one comb at a time, lifting it very slowly and deliberately, and then moving it along into the gap.
- Always hold a top-bar so that the comb is hanging vertically. This takes a bit of practice. The comb may break if you tilt it sideways, especially if it is heavy with honey and the weather is warm.
- During inspection of the hive, always keep top-bars in the same order.
- After a period of honey flow, inspect the hive for honey. Only top-bars holding combs with fully capped honey and no brood or pollen should be removed for honey extraction. Brush the bees gently from the comb with a brush made of grasses or a feather. Cut the honeycomb from the top-bar but leave about a finger's width of comb attached along the top of the bar to guide the bees in rebuilding straight comb. Only the extra honey in outside combs should be removed, as the bees require a certain amount of honey for their own survival.
- When the harvest or inspection is complete and all the top-bars are replaced, push the bars together to ensure that there are no open spaces between them.
- Replace the lid gently; making sure that the hive is firmly closed on all sides.

Basic tips for inspecting a colony

- Check the overall size of the colony: number of combs covered with bees.
- Check that the bees and brood are not suffering from any disease or predators.
- Check for the presence, and the amount of, brood (eggs and developing larvae and pupae).
- Check the amount of stores (honey and pollen).
- Look for any signs of swarming.
- Observe the numbers of drones present.
- Check if the hive is clean inside, and predators are being kept away.
- Be sensitive to the behaviour of the bees and the sounds they are making (these skills develop with time – old beekeepers will tell you that they never stop learning about bees!).

Dealing with bee stings

Inevitably, every beekeeper will experience bee stings. The best way to avoid being stung is to behave in a calm and gentle way with bees. People who are not used to bees, on hearing a bee near to them, tend to waive their arms about, and this is a good way to encourage a bee to sting. Beekeepers are most often stung when a bee becomes trapped in clothing or caught in hair (bees' bodies are hairy, and they easily become 'stuck' in human hair), or when the bees initiate defence behaviour when their nest is disturbed. The bee will die after stinging: it is not in the interest of the colony to lose too many bees this way. However, different colonies differ in their propensity to sting. Some colonies are so defensive that they begin to attack as soon as the hive is approached, and others will follow you out of the apiary! It is important to wash beekeeping clothing to remove the odours of stings, and clean any equipment that may have been stung and has dried venom (smokers, hive tools, etc.). As mentioned above, strong perfumes, deodorants or detergents can also encourage bees to sting. Bees may also be highly defensive when there is a dearth of nectar, when they have large honey stores to defend, or when they are preparing to swarm or supersede.

On being stung, the sting and venom sac are visible, and the venom sac goes on pumping venom for a few minutes. The best action therefore is to remove the sting as quickly as possible – the sting has a barb like a fish hook – a fingernail or the tip of a hive tool or knife blade is the most effective way to get the sting out.

The amount of swelling depends on the thickness of the skin. For example, a sting into the thick skin on the sole of the foot will be painful but may not cause much swelling, whereas a sting in the soft tissues of the face usually causes much swelling. A sting inside the mouth or in the eyeball can be very dangerous. For these reasons, beekeepers should always wear a veil to cover their head when working with bees.

After people have been beekeeping for some time they tend not to take much notice of stings. However, bee stings can be painful, and may be a shock for the beginner. It can be normal to experience considerable swelling: this does not necessary mean the person is allergic to bee stings. If some treatment is desired, a cold compress or application of cooling skin lotion can be used. Proprietary sting remedies that contain antihistamines can, if used several times, begin to cause a sensitivity reaction in the skin. Aspirin is useful if the area of the sting is hot, swollen, and causing more than usual discomfort.

Bee sting allergy or hypersensitivity to bee venom is a very large subject beyond the scope of this text. For more information, see references at the end of this document.

BOX 9

Bee stings - Medical aspects of beekeeping (Riches, 2001)

When a bee stings and venom enters the body, antibodies, known as immunoglobulins are formed. Immunoglobulin G (IgG) is formed in response to bacterial and other foreign substance invasions: it circulates in the blood and is of great benefit in the development of immunity. Beekeepers with immunity to stings usually have high levels of specific IgG in their blood. Immunoglobulin E (IgE) is quite different. After formation it attaches itself to mast cells and very little circulates in the blood. Mast cells are special cells scattered throughout the tissues of the body and are reservoirs of histamine and other active substances. If a person forms excess IgE after exposure to a sting, when stung again after an interval, the IgE that is then adherent to mast cells combines with the venom. This reaction at the cell surface causes a change in the cell wall that allows the liberation of histamine and other substances involved in the inflammatory process. These cause all the symptoms and signs of an allergic reaction. Bee venom hypersensitivity presents in three main ways: (a) large local reactions; (b) systemic reactions; and (c) anaphylaxis.

Large local reactions simply mean excessive swelling after a sting; an example would be gross swelling of the whole leg after a sting on the ankle. This may take 24 hours to develop fully. Systemic reactions usually occur within a few minutes of a sting.

The mildest symptoms are flushing of the skin, followed by an itchy nettle rash. Symptoms that are more serious may include chest wheeze, nausea, vomiting, palpitations, etc. Anaphylaxis is the most serious and must be considered a medical emergency. Its main features are faintness followed by confusion and unconsciousness. Death can occur.

The essential treatment of systemic reactions and anaphylaxis is adrenaline. A collapsed person should be put in the recovery position, with the airway cleared, and then kept warm with coats or blankets. Medical help should be called. Those with a history of serious allergy often carry adrenaline for self-administration in the form of an Epi-Pen. These should be used as quickly as possible at the first sign of a reaction. If there is no benefit within five minutes, the dose should be repeated.

Taking an antihistamine tablet BEFORE being stung can often prevent mild symptoms of hypersensitivity. Hyposensitizing treatment is effective but time consuming and not easily available everywhere.

HARVESTING HONEY AND BEESWAX FROM FIXED COMB AND MOVABLE COMB HIVES

Honey is harvested at the end of a flowering season. The beekeeper selects the combs that contain ripe honey, covered with a fine layer of white beeswax. These combs are usually outer-most ones. As far as possible, combs containing any pollen or developing bees are left undisturbed.

The honeycomb can be simply cut into pieces and sold as fresh, cut comb honey. Alternatively, the honeycomb can be broken up and strained through muslin or another form of filter to separate the honey from the beeswax. After honey is separated from the beeswax combs, the beeswax can be melted gently (over water) into a block. Beeswax does not deteriorate with age and so beekeepers often save their scraps of beeswax until they have a sufficiently large amount to sell.

Equipment appropriate for the harvesting and processing of honey and beeswax

Choice of equipment depends upon the quantities to be processed, and the type of product required. In some areas, traditional beekeeping is practised on a large-scale and may well justify the provision of relatively expensive, large-scale honey processing equipment capable of dealing effectively with honey in bulk for export. Small-scale processing of honeycombs from fixed comb hives, movable comb hives, and frame hives is discussed further in Chapter 9 and 10.

CASE STUDY 2 - TRADITIONAL HONEY AND WAX COLLECTION FROM *APIS DORSATA* IN WEST KALIMANTAN, INDONESIA⁸



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The Danau Sentarum National Park (DSNP) in Kalimantan, Indonesia includes around 132 000 hectares of lakes, seasonally submerged forests and rainforest. The Park has 6,500 inhabitants living in 39 permanent or seasonal villages. The majority of the population are Melayu, whose main activity is fishing. They live in floating houses in villages built on stilts. Besides Melayu, around 10 percent of the population consists of Dayak groups, mainly Iban, who live at somewhat higher sites, mostly with several families living together in longhouses. Their activities, besides fishing, include collecting and selling forest products, hunting and agriculture.

With 3,600 millimetres rainfall per year the lakes are almost continuously filled with fresh water flowing into the Kapuas River. The water retreats only during a short period from July to September, causing some lakes to completely dry out. This seasonality has great consequences for the vegetation. As a result most of the forests in the area are low stunted forests, flooded for most of the year. In the dry season there is a great danger of forest fires, as relatively dense canopies dry out, and dried fallen leaves and wood act as a fuel layer on the soil.

The end of the dry season is followed by a rise in water level, which leads to bud induction and a massive blooming from December to February. This period of flower abundance is vital to the honeybee colonies. Due to the absence of a dry season in 1995 there was almost no honey harvest in early 1996 with the same phenomenon happening in 1969 and 1970.

Nests of *Apis dorsata* the giant honeybee have traditionally been exploited to produce large volumes of honey and wax for trade. Usually when *Apis dorsata* nests are hunted, the bees are chased away with smoke, and the comb is completely cut away for collection. Traditional honey hunters are well known in many areas of Asia where they climb steep cliffs, or ascend tall bee trees using hand-made ladders and local tools (Crane, 1999).

In 1989, the existence of managed honey and wax collection from this bee was confirmed to be still a common practice among beekeepers in U Minh, Southern Vietnam (Crane *et al*, 1992). References and

⁸ Mulder, V. *et al*, 2001.

early notes confirmed that a special system, referred to as rafter beekeeping, had existed for more than a hundred years.

An old Dutch reference from 1851 on an expedition to Kalimantan reported the existence of a similar management system for honeybees, locally called *tikung* beekeeping, which was later described in more detail (Wickham, 1997; De Mol, 1933). As in U Minh, the bee management system described for Kalimantan occurred in an area of submerged forest, with a lack of tall trees (or rock faces) on which bees could build their nests.

This report is the result of a study visit to the upper Kapuas Lake Region, which surprisingly revealed the *tikung* system to be still popularly practised by a relatively large group of the local population. Much use was made of recent studies by project staff of the DFID Danau Sentarum Conservation Project active since 1992 (Giesen and Aglionby, 2000). This Park was gazetted as a wildlife reserve in 1982, and subsequently as a National Park in 1999, with a total area of 132 000 ha. Several studies have described the local honey and wax business on which a Community Based Income Generating Programme was designed (Colfer *et al*, 1993; Rouquette, 1995; Wickham, 1995).

The Danau Sentarum flooded forest contains a variety of tree species. According to the honey collectors, around 20 species are important for honey production. Tembesu (*Fagrea fragrans*) is most important as it is used for making the *tikung* or honey planks. At present beekeepers recognise the following important nectar source trees: masung (*Syzygium claviflora*), tahun (*Carallia bracteata*), tengelam (*Syzygium* sp.), putat (*Barringtonia acutangula*), kawi (*Shorea balangeran*), pecaras or bakras (*Homalium caryophyllaceum*), samak (*Syzygium* sp.) ubah (*Syzygium ducifolium*) and lebang (*Vitex pinnata*). The most popular are honeys from *masung* and *tahun*.

Superior honey is said to be produced from nectar of the ransa palm (*Eugeissona ambigua*) but this plant is very rare nowadays. The palm was heavily exploited in times of famine for its starch content. Honeys from putat, kawi and timba tawang (*Crudia teysmannia*) are known for their bitter taste and are therefore less favoured.

Tembesu wood and rattan (for example, *Calamus schizoacanthus*) are among the most exploited products in the Park. However, timber and rattan exploitation account for only seven percent of the total overall income of the population. By far the largest portion of income for the Melayu (89 percent) is generated from fish resources. Honey production, though variable from year to year, contributes roughly one percent.

HONEY HUNTING PRACTICE

In this article we deal only with *Apis dorsata* (mwonji) that produces almost all of the honey in the area. However *Apis florea/andreniformis* (mwonji lalat) is present in the area and is occasionally hunted. *Apis cerana* (nyerungan) is rare for the lake region, but is found in tree cavities in the higher rainforest surrounding the Park. Also stingless bees (*engke lulut*) are known to produce small amounts of honey.

Although the *tikung* system is the most typical honey production method practised in the Park, honey hunting from tall bee trees is also popular in this region. This technique is locally called *lalau* in Melayu language, or *tapang*, which is Iban language for *bee tree*. Tree species that bees occupy in this area are predominantly: rengas *Gluta renghas*; tempurau *Dipterocarpus gracilis*; ran *Dipterocarpus tempebes*; menungau *Vatica* cf *umbronata*. In a narrower sense, *tapang* refers to *Koompassia* species, of which *Koompassia malaccensis* occurs in the lowland forests around the Park. On elevated land and riverbanks adjacent to the lake area, these tall trees often stand alone, due to clearing for agriculture on the levees. This marks the fact that these *lalau* or *tapang* are respected trees due to ownership, religious beliefs or simply economic value. Between 10-50 and often up to 200 *Apis dorsata* nests can be seen hanging from the thicker branches at 15-30 metres high, forming a wide canopy. Although the bee colonies seasonally

migrate to settle on the *lalau* tree, some trees have nests all year round. Others show only abandoned combs during part of the year. Swarms settle from December to February and are said to come from the hills or rocky mountains that can be seen at a distance surrounding the lakes. A second arrival of bees is said to occur each year from July until October. Honey is harvested on moonless nights in February. Starting in January some colonies from these *lalau* trees are said to move to the *tikung* area – the dwarf or stunted forests in the lakes.

Although local customary laws protect *lalau* trees their number is decreasing. In Meliau six people own 22 *lalau* trees. Ten years ago there were 30 trees: eight have been felled by storms or lightning.

Incidental cutting of bee trees is reported in 1960, 183 *lalau* trees were cut by their Iban owners near Semalah village because of shifting cultivation. At present only six trees remain.

Due to clearance of the forest on the riverbanks no trees are available to the bees, as no new *lalau* have been planted. In primary forest sites young *lalau* trees are recognised by the people and protected as such.

Ownership of a *lalau* tree is maintained for a lifetime and can be inherited. Customary laws define ownership of *lalau* trees, which has to be recognised by the local leadership. If accepted, the whole community is informed and no ownership marks are made on the trees. Determining the right time for harvest is important, and once it is decided, the village head communicates this to all *lalau* owners and families that have the right to share part of the harvest. In the past, in the Kapuas River Delta this communication sometimes required several nights travel for the messenger who would carry a piece of knotted rattan, indicating the number of days remaining until the night of harvest (Dunselman, 1959).

Harvest is carried out at or around the new moon. In most cases, a group of local shamans – specialized bee hunters – gather for this activity. A few days before the harvest, they start making a ladder along the trunk of the bee tree up to the branches. Wooden pegs 30 centimetres long made of bamboo are hammered into the tree trunk at a distance of 1.5-2 metres. A long pole is attached to the end of each peg by rattan. When the ladder is finished, the harvest can commence. Usually around 7.00pm one or two honey hunters ascend the ladder, with a smouldering torch made of dried roots of jabai (*Ficus microcarpa*), a wooden knife and a basket attached to the hunter's waist by a long piece of rope.

The hunters sing songs at various stages of the harvest. There appears to be a basic text formula, which is sung in five stages: (1) finishing the ladder; (2) clearing the bees from the nest; (3) cutting the comb; (4) hoisting the basket; and (5) descending the ladder. The songs are passed from fathers to sons, and are sung to the spirits of the trees to make them friendly. We recorded one such song by a Melayu honey hunter from Semalah, Mr Abdullah Sani.

The songs are humorous, and tease the crowd below, who respond with a whooping yell. Often honey is mentioned in reference to a woman or young girl's beauty and their sexual attractiveness. Local and regional politics can also receive mention in the spontaneous lyrics of the creative singers/honey hunters.

TUNTUNG JANTAK

Tempukung sekuta bangan
Oh nemiak belahar nyumpit
Pakau ku tuntung Tapang dan
Udah ku anjak enda begerak
Udah ku init enda beretit
Paya lucak ulu Tempunak
Ningkam di dalam ulu Sekayam
O...o...o...

NEPAS

Bukan emas sembarang emas
Emas pelinggang se dari Jawa
Bukan tepas sembarang tepas
Serdap di diam si jaga Rengas
O...o...o...

MINTA MADU

Tetak kayu si tetak kayu
Tetak kayu secapit Ubah
Anang nuan seisi' madu
Pecit susu dara di rumah
O...o...o...

NGULUR

Ngiang-ngiang akar genali
Unjung di rumput' setabah tabah
Jaga nuan ini' Sengiang Tali
Kami ngulur lingang bunga lingang Kebaca
O...o...o...

PULANG

Perang alu, perang kelelap
Perang di lengkong si kayu Ara
Pulang ayu, pulang semengat
Pulang semua kita berdua
O...o...o...

THE LADDER IS READY

There are nests of ants in the jungle.
Children learn to shoot the *Sumpit* (blow
darts).
I have already made the *Pakau* (ladder steps)
on the *Tapang* tree.
I climbed, but the ladder didn't move.
Mud in the upper Tempunak river.
And in the upper Sekayam river.
O...o...o... (*yelling by the crowd*)

CLEARING AWAY THE BEES

Not just any gold.
This gold pan is from Java.
Not just to clear away the bees.
But to make the spirits of the *Rengas* tree
friendly.
O...o...o...

TAKING THE HONEY

Cut the log, cut the log.
The logs are cut from the *Ubah* tree.
Don't have no honey.
Else I'll squeeze the girl's breast in the
house.
O...o...o...

BRINGING DOWN THE HONEY

Hanging around the roots of the *Genali* tree.
Don't be afraid to bring it to the grass.
Ask Grandmother Sengiang Tali to protect
you.
We are bringing down some honey from the
Kebaca tree's flower.
O...o...o...

GOING HOME

We've fought against the bees.
We've fought against the *Ara* tree's twisted
bumps.
Go home spirits.
Let's go home all of us.
O...o...o...

Once the honey hunter reaches the branch above a comb, a wooden knife is used to cut the comb. With a smouldering torch the bees are brushed away from the comb, after which they disappear as falling sparks down below. It is believed that an iron knife should not be used to avoid damaging the tree bark, after which the bees would not return. In some cases the brood comb is cut separately and thrown down. The honeycomb is then cut and put into the basket and lowered to the ground. Traditionally these pieces are provided to please any bad spirits.

Honey collected from a single *lalau* tree may be hundreds of kilograms, depending on the number of nests. A study describes a crop of 140 kilograms from more than 20 nests on one *lalau* tree. In this case 16 people, owners and hunters shared the honey. Division of harvest seems to vary with every situation: agreements are probably made *ad hoc* prior to harvest.

Bee nests in *lalau* trees are said to contain more honey compared with *tikung* nests. However, losses due to spillage are higher with *lalau*. The actual average honey crop from a nest of a *lalau* tree is said to be much less than 10 kilograms because of the difficulty in harvesting the entire combs. As mentioned above, in the lake region honey harvest from *lalau* trees is of lesser importance than from *tikung*. In recent years the proportion of *lalau* honey has declined due to the decreasing number of *lalau* trees. Furthermore, *tikung* is more popular as it is an easier and safer way to crop honey.

Beeswax is also collected from the honeycombs. The combs are boiled after which the liquid is filtered. A nest with six kilograms of honey gives about 0.5 kilograms of wax. The prices are about the equivalent of US\$1.2 for one kilogram of honey and US\$1.4 for one kilogram of wax. The villagers immediately consume bee brood from a harvested comb.

TIKUNG

Among the honey hunters that collect honey through the *lalau* and *repak* systems, many also collect honey using the *tikung* technique. *Tikung* is the name of a carved hardwood plank (approximately 0.8-2.5 metres long by 25-40 centimetres wide); one side has a convex and the other side a concave shape. It is made of tembesu (*Fagraea fragrans*) or sometimes medang (*Litsea* sp.). Carving and shaping a *tikung* with simple tools is a time-consuming process – often taking a full day to complete just one board.

Such planks are attached to tree branches in the stunted swamp forests. The ends of the *tikung* planks are carved with notches (mainly rectangular, but sometimes V-shaped) to which a wooden peg is inserted, thus attaching it to a branch.

Tikung planks are positioned with a slope of about 30° with the upper part oriented towards the open sky. The concave side faces downward, so the upper convex side can facilitate rainwater runoff. Sometimes a pole is horizontally attached about two metres below the *tikung* for the *tikung* owners to stand on while attaching or harvesting the *tikung*.

Tikung planks made of durable *tembesu* wood can last over two generations (40 years), and can still be used after enduring a forest fire.

Ownership of a *tikung* is indicated by an individual owner mark – usually a series of indentations at the side of the plank, recognised as the family mark. Each new generation (son) adds a new indent. This mark system is complicated, but well understood by all *tikung* holders in the same area.

In one day, 5-6 *tikung* planks can be positioned in the submerged forest, which is usually two metres above the highest water level during rainy season. The trees preferred for hanging *tikung* planks are kamsia (*Mesua hexapetala*), masung (*Syzygium claviflora*) and empai/timba tawang (*Crudia teysmannia*).

The *tikung* harvest is always done after *lalau* harvest. Prior to the arrival of the swarms, some minor clearance of the *tikung* undergrowth and a small boat channel to the *tikung* may be made. The last blossom from the tahun (*Carallia bracteata*) gives the signal that honey is ready for harvest.

Honey collection from *tikung* resembles that of *lalau*. However, no songs are sung, as no spirits are believed to live in *tikung* trees. It is a collective practice. Harvest is done on moonless nights, usually from 7.00pm until 4.00 to 5.00am during which more than 20 *tikung* can be harvested. In discussions beekeepers said that harvesting in daylight would be very dangerous as bees sting fiercely. (However, in the village of Belibis we were told that in recent years a small group of *tikung* holders had started daytime collecting, using large quantities of smoke. They now seemed to favour daytime harvest as it is quicker due to better visibility. After harvest, the bees returned to the *tikung* for some days, after which they would leave.)

Tools for harvest from *tikung* are similar to that for *lalau*. At present, a plastic or tin container is used instead of the traditional bark/rattan basket. A wooden knife is used to cut the comb. *Tikung* honey collectors believe that if the comb is cut with iron the bees will not return to the site next season. In addition, there is a fear of wounding each other in the dark when harvesting with a sharp iron knife. No protective clothing is used.

The nests are approached in small boats. A man reaches up close to the *tikung* to smoke away the curtain of bees. All bees either fall into the water and drown or crawl up branches and leaves, as it is too dark to navigate and fly. In order to ensure floating bees do not crawl into the boat, other men in the boat use paddles (or their hands) to move the water away from the boat. Usually the brood comb (*sarang anak*) is cut first and temporarily put on top of the *tikung* plank. This enables the honey collector to focus all his attention on the honeycomb, at the head of the *tikung*, which he then cuts and puts into the basket first.

Bees are not likely to return to the *tikung* the following day, and are believed to return to the mountain area. All *tikung* nests in the same vicinity must be harvested the same night to avoid some remaining nests being robbed by other bees.

Tikung owners are mainly Melayu men, however, at harvest night, women and children may join the activity as well. Traditionally the *tikung* owners within the same area formed groups, who abide by their own rules and regulations. These groups also put their *tikung* in the same area. Both that area and the groups are called *priyau*. In the past, each *priyau* belonged to headmen, who gave his subordinates rights to place *tikung*. The *priyau* area was hereditary and sometimes subdivided to each one of the inheritants. The owner marks on the *tikung* reflect these interdependencies of *tikung* holders in the same *priyau* caused by inheritance.

At present rules applying to *tikung* owners in the same *priyau* include: a minimum number of *tikung* to be put up (for example 25 in Leboyan); obligation to put all *tikung* in one *priyau* only; a minimum distance between two *tikung* positions (for example, 15 metres in Leboyan); and to report the number and positions of *tikung* to the head of the *priyau*.

The 1994 study gives data on the number of families, *tikung* holders and number of *tikung* per family for selected villages in five main *tikung* areas: 30 percent of the families owned *tikung*, one family having from 10-500 (in Leboyan the average was 81 per family). The number of *tikung* occupied by bee nests in that season was around 23 percent. Average honey yield per collected nest was around six kilograms. This gives a total production figure for all of the Danau Sentarum Lake area for that year to be between 20 and 25 tonnes (an average year).





CASE STUDY 3 - RAFTER BEEKEEPING IN MELALEUCA FORESTS IN VIETNAM⁹

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The honeybee *Apis dorsata* is indigenous to tropical and subtropical Asia. The bees build their nests from the branches of big trees and tall, projecting cliffs. Occasionally colonies build nests on high water towers or the roofs of buildings. The nest comprises a single comb in the open air. *Apis dorsata* are defensive and migratory, and the domestication of this bee was thought impossible.

In some *Melaleuca* forests of southern Vietnam, people use a traditional method of collecting honey and wax from *Apis dorsata* colonies. This method of “rafter beekeeping” was first reported in 1902 by Fougères (Fougères, 1902).

According to Vietnamese sociologists, in the early 19th century honey hunting or rafting was the most important occupation of the people who lived in the *Melaleuca* forest swamp. At that time people paid taxes to the government in exchange for living in the forest. Beeswax was used to pay tax and for making candles and was sold to visiting ships from Hainan, China (Dau, 1992; Son Nam, 1993).

Between 1945 and 1975 the forests were devastated first by wars, and then by forest clearing for wood and agricultural purposes. As a consequence rafter beekeeping dramatically decreased in the area.

The technique is still used today at the state farm of Song Trem in Uminh forest, South Vietnam. According to our survey, there are about 96 beekeepers in the area. In 1991, they harvested 16,608 litres of honey and 747 kilograms of wax.

What is a rafter?

Simply, a rafter is the trunk of a tree, two metres in length and 15 centimetres in diameter supported by two vertical poles. One vertical pole is about 2 m high and the second 1.2 metres high. The rafter therefore slopes at an angle of about 15-35° to the horizontal. It appears like the branch of a tree and *Apis dorsata* can build its nest beneath it. It is named rafter because it looks like the rafter of a house.

How to make a rafter

A tree trunk 1.8-2.2 metres long and 10-20 centimetres in diameter is split lengthways into two parts to make two rafters. A rectangular or triangular hole is made at one end of the rafter (when the rafter is erected, the hole is slotted over the top of the higher vertical pole). A channel is often made along the flat side of the rafter to drain off rainwater so that it does not seep into the comb. The bark is removed and some beekeepers cover the curved side with a thin layer of beeswax.

How to erect a rafter

The beekeeper chooses a quiet, open space in the *Melaleuca* forest, or makes one by cutting down some tall trees. The direction of the rafter is decided before the vertical poles are positioned. The rafter is supported by the higher pole with the hole in the rafter slotting over the end of the pole. The lower pole supports the rafter with its V-shaped top. The curved side of the rafter must face downwards.

Grasses and small trees beneath the rafter are cleared. Finally the rafter is shaded using small branches and leaves. The rafter is now an ideal place for an *Apis dorsata* colony to build its nest.

How to harvest honey and wax

A good beekeeper knows when the honey is ripe for harvest by observing *Melaleuca* in flower, or the water collecting activity of the worker bees. On average the first harvest can take place 20-30 days after the rafter is occupied. The second harvest can be carried out about 30 days later. It is possible to harvest a third time from these colonies.

The bees are chased away using a torch of dry leaves and *Melaleuca* leaves. This used to be the main cause of forest fires in the area and therefore since 1993 smokers have been used.

⁹ First published in *Bees for Development Journal* 36 (1995) pp. 8-9.

Honey is stored in the highest part of the comb and it is cut off without destroying the brood. Beekeepers usually cut a part of the brood from a big colony because they believe that if they do not the next harvest will be smaller. This does not seem logical – the more bees, the more honey produced for harvesting. It is possible however, that when the brood is cut, queen cells are removed which prevents swarming.

Honey is squeezed, filtered and then sold in the local markets. Beeswax is harvested from the honeycombs. Very little wax is taken from old brood combs.

Flower supply and honey harvest seasons

The *Melaleuca* forest in Vietnam is located in Asia’s tropical monsoon area. The weather is generally hot and humid. There are two season in the year: the dry season from December to April and rainy season from May to November.

Melaleuca is the main forage plant in the forest, with other flowers in small quantities. *Melaleuca* blooms mostly from January to April and June to August. The bees come to the area in December and stay until May. The first honey harvest is between February and April. In May the colonies fly away and return in June. The second honey harvest season is in July and August after which the bees depart. At other times of the year, some *Apis dorsata* colonies can be found in the *Melaleuca* forests, but honey is stored only in small amounts.

A video of this rafter beekeeping was awarded ‘The Gold Medal’ at the Apimondia Congress in Lausanne in August 1995.

