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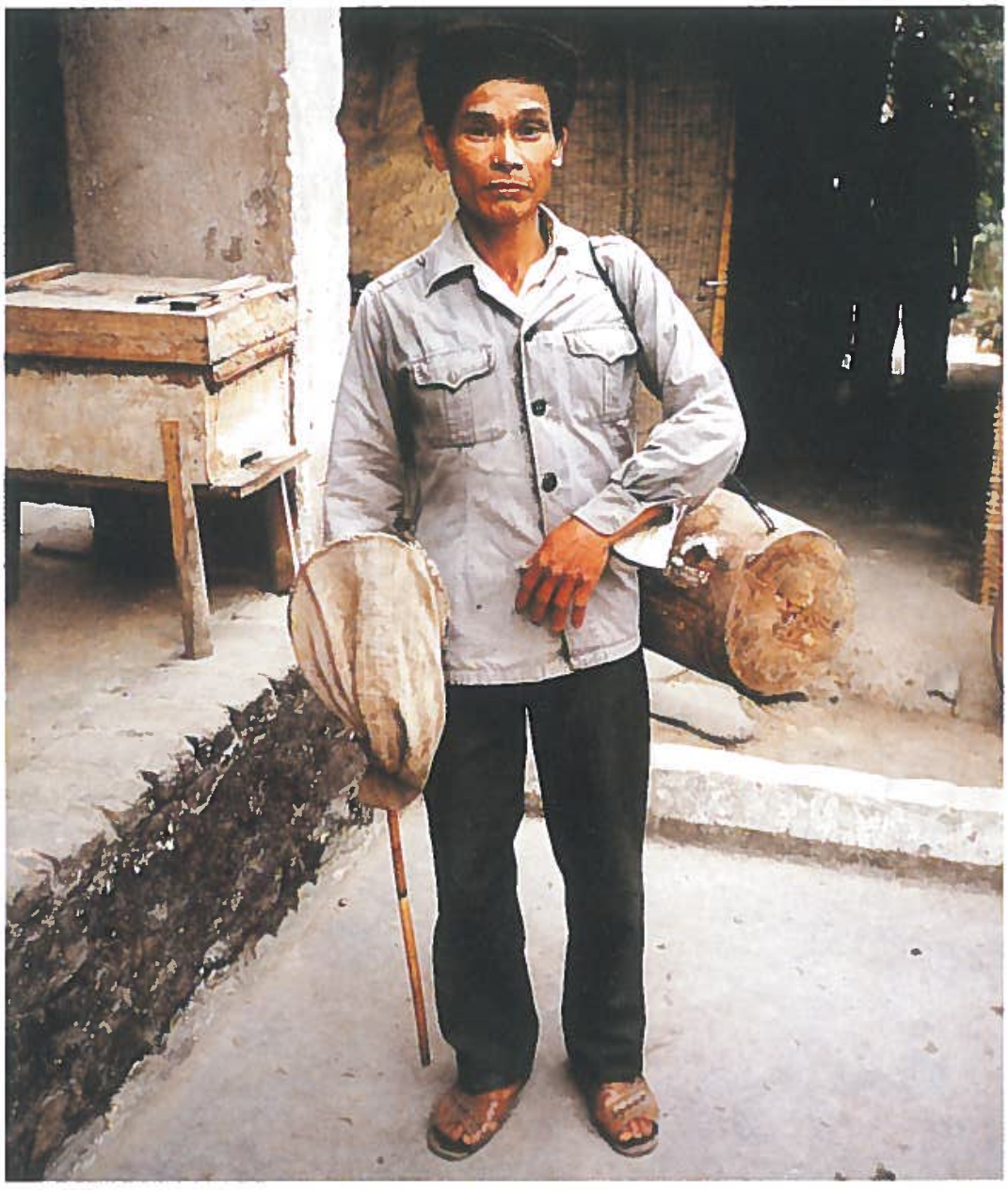

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Cover:
A swarm collector in Bac Thai province with his equipment: a bait hive and a butterfly net.

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Traditional bee management as a basis for beekeeping development in the tropics

Proceedings of the first NECTAR seminar,
held at the Royal Tropical Institute, Amsterdam, 7 May 1990

Editors: Jacob Kaal, Hayo H.W. Velthuis, Frans Jongeleen,
Joop Beetsma

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The association NECTAR

In the past 20 years, advice concerning beekeeping projects in (sub)tropical countries, initiated by Dutch institutions of development assistance or foreign institutes, was given by individual scientists working in the field of honeybee research or by a few more or less experienced beekeepers. However, the number of persons who obtained experience with (sub)tropical beekeeping increased considerably during this period and the need was felt to exchange and centralize the knowledge of and expertise on beekeeping in the (sub)tropics in an association. Thus, the Netherlands Expertise Centre for Tropical Apicultural Resources (NECTAR) was founded in 1990. It is a non-governmental, non-profit association of (sub) tropical beekeeping experts in the Netherlands.

The members of NECTAR have obtained thorough working experience in several countries in Asia, Central and South America, Africa and Australia. They have worked with different bee species, e.g., the African and Western honeybee (*Apis mellifera*), the Eastern honeybee (*Apis cerana*), the Africanized honeybee and stingless bees. Because NECTAR members have different backgrounds and working experiences, the association is able to advise beekeeping development organizations in the following areas: feasibility studies, proposals, funding, technical assistance and evaluation of development projects. The association has a sincere interest in the questions and problems of potential and existing individual beekeepers and groups of interested and willing people.

The necessity for cooperation between Dutch beekeeping experts was also felt because it was frequently noticed that both Dutch and foreign institutions did not recognize the special nature of beekeeping activities. Adequate expertise was often lacking in the project proposals. For example one such proposal contained the condition that the project should become self-supporting by exporting the honey produced within five years. This is a gross overestimation of the actual possibilities, as outlined below.

When beginning in an area where a local honey market is present

but where only traditional beekeeping methods are known, it will take at least five years to organize the beekeepers, even in a restricted area, and to make some progress in their management techniques. Instruction concerning more advanced beekeeping methods and the construction of improved hive types need to be repeatedly given over a period of several years. To produce honey for the world market may seem the highest goal to be reached; however, in most countries the local market is much more profitable. This is not only because of the price, but also because of the quality standards of honey on the world market. To avoid disappointment of both beekeepers and financing organizations, it should be stressed that, during the initial years of a beekeeping project, little honey or any other bee product can be produced.

In addition, the local conditions of the level of technical development, the means of communication and the possibilities of transport were often not considered in the proposals. Now, due to the cooperation of NECTAR members, our association is able to assess the possibilities in a better way. We intend to carry out this advisory work in cooperation with other organizations active in this field. The aspects mentioned have been published more extensively in the quarterly magazine on technology and development, a joint publication of Agromisa, ATOL, CICAT and TOOL: AT-source, Volume 18 (1): 11-27 (1990).

The NECTAR symposium

The subject of the NECTAR symposium, held in the Royal Institute for the Tropics in Amsterdam on May 7, 1990, was „Traditional bee management as a basis for beekeeping development in the tropics". The invited speakers were:

Dr Eva Crane, former Director of the International Bee Research Association, who after her retirement continues to dedicate her time visiting developing countries in relation with beekeeping. Recently, she finished writing an extensive book entitled 'Bees and Beekeeping, Science, Practice and World Resources', Cornell University Press, Ithaca, New York (1990);

Mr. David Wainwright and his colleague Mr. B. Malichi, who

have worked for several years on a beekeeping project in Zambia using bark hives;

Mr. Jaap Duijvetter, who has worked for many years as a beekeeping instructor at the Beekeeping Advisory Station in Hilvarenbeek, The Netherlands. He has instructed beekeeping teachers and worked with skep beekeepers.

The other speakers of this symposium, all members of NECTAR, were:

Dr Marinus Sommeijer of the Laboratory of Comparative Physiology, Section Social Insects, University of Utrecht, The Netherlands, who has obtained experience with beekeeping with stingless bees in Central America. In 1990 he and his students started a project in Costa Rica concerning the domestication of stingless bees;

Mr. Vincent Mulder, who has worked for several years in Vietnam and instructed the beekeepers how to improve the quality of their honey. He has organized the training of Vietnamese beekeeping researchers and students by members of the Department of Entomology of the Agricultural University in Wageningen, The Netherlands;

Mr. Remy de Vries, who has worked in a beekeeping project in East Java, Indonesia and is now involved in a similar project in Nepal.

We want to thank Mr. Mulder and Mr. de Vries for all the work they carried out in preparing this symposium and the Board of the Royal Institute for the Tropics who placed their facilities at our disposal. We especially thank Mr. Fred Scholten, co-worker of the Royal Institute, for his intervention to obtain the facilities mentioned above.

We want to express our gratitude to the Directorate General for International Cooperation, Ministry of Foreign Affairs of the Netherlands, for the financial support of our activities.

We are convinced that traditional beekeeping systems can be improved. However, changes to be introduced must be within the reach of the local conditions.

Joop Beetsma
President of Nectar

Traditional bee management: definitions and some examples in the tropics and subtropics

Eva Crane

1. Stages of development of traditional bee management

In discussing the subject ' Traditional bee management as a basis for beekeeping development in the tropics', it is essential that each of us understands what others mean by traditional bee management, what it includes, and what it excludes.

During the past year or more, I have been writing early chapters of a world history of honey hunting and beekeeping. In doing this, I have come to recognize the following stages in the development of man's traditional relationship with social bees that store honey.

Without bee management:

(1) opportunistic honey hunting from wild (feral, natural) nests

(2) honey collection from wild nests owned by individuals or communities

Start of bee management:

(3) tending of wild nests in situ

Start of beekeeping:

(4) use of simulated natural nest sites in situ, such as tree cavities for *Apis mellifera* and 'rafters' for *A. dorsata*

Start of apiary beekeeping:

(5) moving natural nest sites (with their nests) to apiary; these become fixed-comb hives

Advances in beekeeping using fixed-comb hives:

(6) using simple purpose-made hives in an apiary

(7) using such hives in a more advanced way

(8) using horizontal hives with a removable top or bottom

(9) using such hives with an extension for honey storage

Advances to movable-comb hives:

(10) single-chamber top-bar hives

(11) top-bar hives with an upper honey chamber

2. Definitions

My provisional definitions are as follows.

(a) I regard bee management as wider than beekeeping (see section 1), and include in it the tending of nests *in situ* as well as in hives/apiaries.

(b) A hive is a purpose-made nest site for a colony of honey storing cavity-nesting social insects (usually bees): *Apis mellifera, A. cerana, Meliponinae, Bombus* spp. The term must however include common-purpose receptacles such as water pots adopted as hives.

(c) Beekeeping involves the use of hives as in (b), and I would extend it to cover the use of a simulated natural nest site *in situ* or the movement of natural nest sites (e.g. logs) to a place that is more convenient for the beekeeper. As with the keeping of other livestock, beekeeping includes attending to the well-being of the bees while they are alive, although it may also include killing them.

(d) We are using the word *traditional* as applied to activities or techniques, and in this sense, according to the Oxford English Dictionary, it means ' based on methods handed down from ancestors to posterity, especially by oral instruction and by practice'. A *traditional hive* is one used in traditional beekeeping.

3. Examples of traditional bee management for cavity-nesting honeybees

Numbers (3) to (11) are those used in Section 1, and all types of hive mentioned here are described by Crane (1983).

In general it is very difficult to examine brood combs in natural nests or in fixed-comb hives. If mites parasitic on bees are introduced to an area where such hives are used, most colonies in them are likely to be killed before traditional beekeepers become aware of the existence of the mites, so that type of beekeeping may be destroyed.

In the forest of Northern Europe, nests of *Apis mellifera* were extensively tended in natural tree cavities *in situ* (3). Artificial cavities

Figure 2. Removed comb (see fig. 1, page 17) with its twig, ready for fixing in an empty hive.

were also gouged out for beers to nest in (4) and this is also done for *A. cerana* in Sekong Province, Laos (Khatri, 1989).

3a Fixed-comb hives

Hives that simulate natural nests (4), used in situ, include also hollow logs or other containers of a similar shape supported in trees. This siting provides considerable protection against predators, and a more equable temperature than close to the ground. Various improved types are used in Africa; for instance Tugen beekeepers in Kenya pre-cut the log lengthwise, so that they can open the hive along the cut and get access to all the combs at once (Nightingale, 1976).

Traditional apiary beekeeping (5) in Northern Europe probably started when hollow logs containing bees' nests were stood upright on the ground, in a group protected against bears by a wall or other contrivance. Swarms would then be housed in other empty logs.

Traditional apiary beekeeping with purpose-made hives (6) probably started in Ancient Egypt as early as 5000 BC, and it spread throughout the Mediterranean region. The hives were horizontal cylinders made of earth materials (sun-dried mud or fired pottery) or, in some regions, woven from plant stems. They

Figure 3. Hive made from a coconut log, with a removable smaller upperpart, as used in Indonesia and Malaysia.

Figure 1. Beekeeper removing a comb from a horizontal mud hive opened at the rear (near Minia, upper Egypt).

Figure 5. Greek top-bar hive with one comb partly removed.

Figure 4. Hive of fired clay with a honey extension (Gharb, Morocco).

were often arranged in stacks (Figure 1, see page 17), or embedded in a wall or other structure. This arrangement occupied little land area, provided protection against marauders, also gave some thermal insulation.

Several developments of this type of beekeeping are worth consideration in development programmes, if fixed-comb hives are to be used, since they represent advances (7) on the simplest form of hive beekeeping.

(a) In Ancient Egypt and in some other regions, the horizontal cylindrical hives have a removable closure at each end. The bees' flight entrance is at the front, and the hive can be opened at the back. The bees are smoked through to the front and out of the flight entrance. Honey combs can thus be removed from the back without interference from the bees, and the food can be inserted there.

(b) In Egypt today, and I believe also in Ancient Egypt, the hive can alternatively be opened from the front, to remove brood combs one at a time, using special tools. A swarm (or part of a colony, for making increase) is housed in an empty hive primed with a few 'guide' combs from an occupied hive, fixed

across it at the front end with a forked twig (Figure 2, see page 15); the bees build subsequent combs parallel to the guide combs.

In the tropics, advances in fixed-comb hives include a removable top (8) to a horizontal log which gives access to all combs at once, as in Figure 3 (see page 16). Hives may also be made of bark (including cork) or plant stems, or other lighter materials. In many Mediterranean areas other than Egypt, a hive extension (9) is added at the back of the hive during the flow to provide a honey chamber; see Figure 4 (page 18).

3b Movable-comb hives

I do not know of any traditional movable-frame hives, but use of traditional movable-comb hives has been known in Greece since 1682 for *Apis mellifera* (Figure 5, see page 17), and in Vietnam since the 1920s for *A. cerana* (Figure 6, see page 20). Both uses probably existed earlier, perhaps even in the Ancient World, although we have no clear evidence on this (Crane & Graham, 1985; Crane *et al.*, 1990; respectively). Both types of hive are round upright vessels, with top-bars laid, at a spacing appropriate for the size of the bees, across the open top. Any comb can be lifted out by its top-bar, since the bees do not attach combs to the hive sides. It is generally accepted that the sides need to slope inwards towards the bottom to prevent attachment. But the behaviour of *A. cerana* in this respect (and even of *Apis mellifera*) needs more study.

In any case, the bees are much less inclined to attach brood combs than those used for honey storage. In one type used in Vietnam, top-bars are half-way up the log; the part below is the brood chamber, and the upper part the honey chamber, its combs being attached to the underside of the flat roof.

As I see it, the use of the round top-bar hives reported in Greece and Vietnam represent the acme of traditional beekeeping with cavity-nesting bees, and they are especially worth consideration for development programmes in the tropics.

Figure 6. Log top-bar hive with one comb removed (Moi tribe, BacThai, northern Vietnam).

4. *Examples of traditional management of open-nesting bees*

Some of the honeybees in tropical Asia (*Apis dorsata*, *A. florea* and associated species) nest in the open. A colony builds only one comb, very large (up to 2 m wide) for *A. dorsata* and rather small (13 to perhaps 20 cm or more) for *A. florea*. The combs in the wild are widely collected for their honey and wax. Also, in few areas, one or other species has been traditionally managed, although until a few decades ago this seems to have been unknown outside the area involved.

A. dorsata nests are managed in forests of *Melaleuca leucadendron* in the Mekong delta, southern Vietnam (Crane *et al.*, 1990), and in the Kapuas lake region of Kalimantan, Borneo (Mol, 1933). Each year when *A. dorsata* swarms are due to migrate in, beekeepers fix slanting narrow wooden boards in trees, and the bees accept these as if they were strong tree branches, and build their combs down from them. The boards are known as rafters because of the customary slanting position in which they are placed, like rafters of a house.

A. florea supports its comb from a thin branch, building the honey storage part (with very long cells) right round the branch. The brood part is below, and has much shorter cells. In parts of Oman (Dutton & Simpson, 1977; Crane, 1990) and of the Indus valley in Pakistan (Khan, 1989), the beekeeper clamps the comb just below the honey area within a split stick, or (in Oman) between two halves of a palm frond. The honey comb above the clamp is cut off and harvested. After the next honey season, another clamp is fixed below the new honey storage area, and the process is repeated. In Oman, tended nests are housed either in caves excavated in the ground or in wall recesses, either being provided with shade. In the Indus valley, nests found far from the house are taken home on their supporting branch, and set up in some convenient place; those found close by are tended *in situ*. I would class the latter operation as bee management only; where they are moved to an apiary, I would call it beekeeping.

In one part of India, an apiary beekeeping system has been developed for *A. dorsata* (Mahindre, 1968; see also Crane, 1990).

5. Rational (Post-traditional) bee management with honeybees in hives

From the 1600s onwards, various European beekeepers with enquiring minds started to think about, and experiment with, improved hives that might overcome the disadvantages of traditional fixed-comb hives (Fraser, 1958).

The new advantages were no longer traditional, beekeeping passed on from one generation to the next in person: ideas were discussed in meetings, by correspondence and in publications. The most productive improvements were based on the round Greek top-bar hive (Figure 5), in which the bees built combs down from individual movable top-bars. The improvements culminated in the hive devised by Langstroth in 1851 and described in his 1853 book. Instead of a top-bar to support each comb, he provided a four-sided frame, and the whole frame (with its comb) was movable. The term rational beekeeping was sometimes used for bee management that resulted from Langstroth's ideas, and Dzierzon used the title *Rationelle Bienenzucht* for his 1861 book; it was published in English in 1882 as *Dzierzon's rational beekeeping*. He said: „The bee-keeper who has not learned better... does it (beekeeping) after the manner of his father and grandfather before him. It is otherwise with the rational bee-keeper. He conducts his business systematically, interposing in the economy of the bees, at one time stimulating, at another time checking, and having for everything that he does *a reason why*."

Movable-frame hives must be precision made; also, they were devised when well seasoned wood was plentiful and cheap, and the cost of skilled woodworking was low. Any or all of these characteristics may rule them out for use in a development programme today.

I have told the story elsewhere of the production in the 1950s of top-bar hives with a rectangular top opening (Crane, 1990). All top-bars in these hives are of the same length, and are thus interchangeable as well as removable. If necessary the hives can be made cheaply of local materials, since their only precise dimension is the spacing of the top-bars, which must be appropriate for the size of the bees used (Crane, 1990).

I would include as rational beekeeping the use of all hives with combs that are movable and interchangeable, whether they are supported by top-bar or frames.

6. *Conclusion*

The management methods and hives for any particular development programme in the tropics must depend on circumstances, and it is at least as important to suit them to local human factors as to suit them to characteristics of the bees.

Apis mellifera and *A. cerana* build parallel combs in a cavity, and details of their management depend greatly on the type of hive used. I understand very well the objections to movable-frame hives with their many requirements for precise dimensions. But for many situations I think that we should extend our considerations beyond traditional hives, to rational hives closely related to the most workable of them, particularly to movable-comb hives in which all top-bars have the same length. And whatever type of hive we use, I believe that we should take advantage of all appropriate post-traditional methods of teaching and transmission of information.

Both traditional and rational hives have also been developed for stingless bees, which nest in a cavity but build rather irregular comb; I have discussed them elsewhere (Crane, 1990).

I find it exciting that we now know of quite advanced traditional management methods for the tropical open-nesting bees *A. dorsata* and *A. florea*. These methods have arisen in four countries, and in rather specific habitats. A useful consideration of the promotion of such methods elsewhere must include a search for other areas with valid habitats. Perhaps we can hold a further meeting on this interesting subject, which breaks new ground as far as most of us here are concerned.

7. *References*

Crane, E. (1983) *The archaeology of beekeeping* (London: Duckworth)

Crane, E.; Graham, A. J. (1985) *Bee hives of the Ancient World*. Bee Wld 66:25-41, 148-170

Crane, E. (1990) *Bees and beekeeping: science, practice and world resources* (Oxford: Heinemann Newnes)

Crane, E.; Luyen, V. V.; Mulder, V.; Ta, T. G. (1992) *A traditional management system for A. dorsata in submerged forests in Southern Vietnam and Central Kalimantan* to be published in Bee Wld

Dutton, R. W.; Simpson, J. (1977) *Producing honey with Apis florea in Oman*. Bee Wld 58 (2): 71-76

Dzierzon, J. (1861) *Rationelle Bienenzucht*... (Brieg), translated 1882 as *Dzierzon's rational bee-keeping* (London: Houlston)

Fraser, H. M. (1958) *History of beekeeping in Britain* (London: Bee Research Association)

Khan, K. (1989) Personal communication

Khatri, B. (1989) Personal communication

Langstroth, L. L. (1853) *The hive and the honeybee* (Northampton, MA: Hopkins, Bridgman)

Mahindre, D. B. (1968) *Apis dorsata* - the giant bee of India. *Glean. Bee Cult.* 96(2): 102-108

Mol, G. A. de (1933) Inzameling van was en honig in het Meerengebied van de Westerafdeeling van Borneo. *Landbouw* (2): 80-86

Nightingale, J. M. (1976) Traditional beekeeping among Kenya tribes, and methods proposed for improvement and modernization. *Proceed. 1 Conf. Apic. trop. Climates:* 15-22

Toumanoff, C.; Nanta, J. (1933) Enquete sur l'apiculture au Tonkin. *Bull. econ. Indochin.*: 1015-1048

Whelar, G. (1682) *A journey into Greece* (London: T. Cademan)

From forest to supermarket: Traditional beekeeping in Zambia

David Wainwright

1. Introduction

Among the various honey brands and different honey jars on the supermarket shelves in Western Europe a new special honey can be found since very recently; one produced by tribal beekeepers, using traditional techniques, deep in the forest of Central Africa. This honey is one of a new generation of products coming from the tropical forest, and as such a direct 'harvest from the forest'.

Harvesting products from the forest is believed to be a sound alternative to cutting it down and selling the wood; it helps preserving the forest ecosystem, and at the same time respecting the human rights of the people who live there.

Regarding the history of forests and people in Africa, there is evidence that traders of many early empires from the Phoenicians to the Chinese established regular trade, exchanging manufactured items for African minerals and forest products. Within Africa these foreign goods as well as African manufactured items were disseminated through vast trading networks, which probably reached even the most isolated communities.

One major effect of white colonialism in Africa has been to destroy the local productive industries and the traditional expertise as foreign manufactured goods were flooded into the market. Even traditional African exports such as forest products, and to some extent minerals, were superseded by Western manufactured items. So the role of the African diminished from producer of a valuable item to a badly paid plantation worker or producer of an agricultural commodity where price falls year after year.

2. The development of traditional beekeeping

In Southern Central Africa - what is now Angola, Zambia, Tanzania and Mozambique - beeswax is a forest product with a long trading history. The Catholic Church burnt vast amounts of beeswax candles every year. Thousands of tons were gathered from the large numbers of honey bee colonies in the forest. Traders from Portugal, Britain, Zanzibar etc. set up networks reaching from the coast to remote trading posts in the forest. As the market for slaves, ivory, rubber etc. weakened, these traders turned their attention to other products including beeswax.

Based in their villages collectors would travel into the forest in small groups to collect beeswax. Camps were set up in suitable forest areas up to 50 miles from the village. The men would stay in the camps for several weeks, cropping the honey combs from wild bees' nests, processing the beeswax, hunting, fishing and in the evening drinking beer brewed from the honey.

As the trade in wax increased; the beekeepers had to travel further in order to increase the number of wild nests being cropped. Good collectors would always leave enough honey so that the bees would remain in their nest cavity, usually a hollow tree. However, a point came where production of beeswax was limited by the number of natural nest sites available. So, in some way the idea of making artificial nest sites developed; man-made hives were hung in trees, waiting for swarms of bees to come and occupy them (see Figure 1, page 33). These hives are made of tree bark, hollowed out logs, basketwork, calabashes etc. usually in the form of a cylinder about 1. 5 m long by 30 cm wide (Clauss et al., 1989; Dubois et al., 1950) - (see figure 2, page 36).

3. Forest conservation

The most popular hive designs such as the bark hive are made of materials readily available in the forest and are quick to make, so that a beekeeper usually owns 200-300 hives. As beekeeping is a common activity, this represents a considerable impact on the forest ecology. The beekeeper often destroys a tree for each hive made, but this activity probably results in a higher density of bee colony population,

which in turn affects the pollination of many trees and other plants. The forest we see today has probably been shaped to some extent by beekeeping activities over the last 150 years. However, it is important to understand that beekeeping is not a cause of deforestation. Hive making is a selective activity which removes scattered individual trees of a certain species, size and growth performance (see Dubois et al.,; 1950). The forest, also at present, can tolerate such a form of tree cropping easily, as it is not related to any form of land clearing.

Beekeepers have a vested interest in forest conservation, because the forest is providing them with a part of their income. However, beekeepers might also have other productive activities which can give them a vested interest in damaging the forest. For instance, many beekeepers hunt animals for the sale of 'bushmeat'. A common tactic is to make bush fires at the end of the dry season. Animals are attracted to the new green shoots of grass, which emerge after the fire which also clears the forest of dry grass where the animals could hide. However, these late fires can easily get out of control and burn so fiercely that even mature trees are damaged and the flowers that the bees feed on are scorched dry.

Often the hunter/beekeeper will decide on which activity to invest his labour from a commercial point of view, depending on which activity gives the best return in cash or for barter. Therefore, if the value of his honey and wax increases so that beekeeping becomes more worthwhile than hunting, one outcome will be an increased tendency to conserve the forest.

4. Bee management

The beekeepers spend most of their time on two activities, making hives and cropping the honey. There is no attempt to manage the growth of the bee colony as in Western frame hive beekeeping or any other form of apiary beekeeping. The newly made hives are hung high in the trees scattered in the forest, out of reach of forest fires, army ants, honey badgers and other enemies.

Just before or at the beginning of a honey flow, when one of the main tree species begins to yield nectar, swarms of bees can often be seen migrating across the forest. If it is a good season most hives will be occupied in a couple of weeks. It is not clear if these swarms after

absconding move in from other areas or are reproductive swarms from colonies remaining in the same area. The successful beekeepers, who have built up large numbers of hives, sometimes up to 2,000 or more, can leave the swarms undisturbed for 3-5 years before cropping them. During this time the bees will have built a large amount of honeycomb and 20 kg or more can be cropped. If the swarm is cropped after only one season, only 5-8 kg can be harvested (Wainwright, 1989b).

Much of the skill of the traditional African beekeepers is in cropping the honey. It is remarkable that, considering the reputation of being dangerous, most of the traditional beekeepers have cropped honey for years without any protective clothing whilst climbing high in trees. This is a skilled operation which needs detailed knowledge of different factors, such as the honey flow conditions, time of the day, history of each hive, use of the smoker etc.

The design of traditional hives helps the beekeeper to control the bees as smoke can be easily blown into the open end of the hive so that the bees run to the combs at the other end and congregate away from the beekeeper. It is then a simple matter to cut the honeycombs out until about half remain in the hive, which thereafter is tightly resealed with pieces of bark or a coiled grass disc, leaving the bees to build new combs again.

5. Traditional versus Western technology

The design of traditional hives and the methods of using them have been developed by the African villagers so that they can harvest large quantities of honey and wax with the minimum hinder of stings and with maximum economical use of their local resources and labour. This type of village technology requires no capital investment, so nobody is excluded from participating in production due to lack of capital. Even refugees from the conflict in Angola, without any possessions except a knife and an axe, can earn an income from beekeeping.

Traditional hives have persisted in use despite government policies in many African countries to replace them by the 'advanced' or 'modern' frame-hive as used in Europe and USA. Although claims

are made about the massive quantities of honey to be harvested from these hives, the evidence on the ground is that this technology has not spread among the rural population. The same is also true for the intermediate technology top-bar hive. The reason for this is that it is more difficult to control African bees in top-bar and frame-hives. Moreover, the investment costs for such hives, which need to be made from expensive sawn timber, and its equipment required are relatively much higher. Only the rural elite could afford to invest in honey production using such hives (see Wainwright, 1989b, 1989c; Villières, 1987).

Many Western experts have assumed that the traditional village techniques need to be replaced by the techniques used in the West. This is justified by the assumption that the Western methods are more productive. However, under the village conditions the traditional technique usually proves to be more productive. But often this is only discovered after failure of the imported methods and waste of time, materials and the labour and patience of the local people.

6. Marketing; the first problem

The real problem faced by the village people is often not producing a product, - it is selling the product. In North Western Zambia the people are expert beekeepers and can quite easily produce large quantities of honey and wax, given the right weather conditions. They have two problems; firstly they need a regular market for their goods at an attractive price, and secondly they have to carry the honey large distances from their forest camps to their villages. There is not much that can be done about the second problem, but many efforts have been made to solve the first.

7. Changing market and policies

Up until the early seventies there was a market for beeswax only; the beekeepers would carry balls of wax for several days to reach a trading post where it could be exchanged for manufactured items: cloth, salt, soap, bicycles, cooking pots etc. Although it might appear that the long journey carrying 20-30 kg of wax on the head might be a disturbing factor, the system worked to the extent that production of

wax was highest at this period. Old beekeepers remember this system fondly, the value of wax being high in relation to manufactured goods, the traders were generous with hospitality and there was the chance to meet other beekeepers, friends and distant cousins at the trading post. What is not mentioned is that the British Colonial regime imposed a hut tax which had to be paid in cash. This would have been another motivation to produce goods for sale.

After independence, State owned marketing organisations were set up with the aim of reaching all producers with a marketing service offering standard producer prices throughout the country. Beekeeping declined under this system as producer prices became increasingly unattractive, services were late and payments delayed, sometimes indefinitely. As one para-statal failed another was created and eventually the marketing of honey and beeswax came to be dominated by a government department: the Beekeeping Division.

The Beekeeping division implemented a new policy of buying both honey and wax from the beekeepers and trying to reach most of the villages. This enabled the beekeeper to earn far more from his hives, as before he only used honey for brewing beer, while much of the honey in good years simply was squeezed out of the combs onto the forest floor to save the trouble of carrying it.

The Beekeeping Division suffered from many of the problems of Government Departments trying to carry out commercial activites. The most important was the clumsy mechanism for setting the producer prices. These had to be agreed by the Central Committee of the Party (UNIP). This would mean a delay of up to two years before new prices could be implemented, by which time they had already been overtaken by inflation. There was no involvement of the local community, either beekeepers or politicians, and decisions were taken far away in the capital. Motivation and enterprise amongst the beekeepers declined to an all time low as producers waited for a marketing service which never came.

As local criticism of the existing service mounted and the need to diversify exports intensified, the government, desperate to stimulate growth in the rural economy, experimented by allowing liberalization of the beekeeping industry. Working at a local level the honey and wax marketing service evolved into an entirely new form of organisation. The former Government department was reformed

into a united company that consisted of the District Counsels and the masses of beekeepers. The company was called North Western Bee Products (NWBP).

8. NWBP, participation in production and marketing policy

Its first merit was the freedom to set producer and sales prices independently, in response to the market situation; this immediately resulted in a jump in production. Eventually this process culminated in prices being negociated in mass meetings of the beekeeper's leaders and the management of the marketing network. The process of negociating, carried out over several days, gives the 200 - 300 leaders of beekeeping groups the chance to listen to all the arguments concerning marketing. When a decision is eventually reached the leaders feel responsible for it and return to their villages to motivate the population.

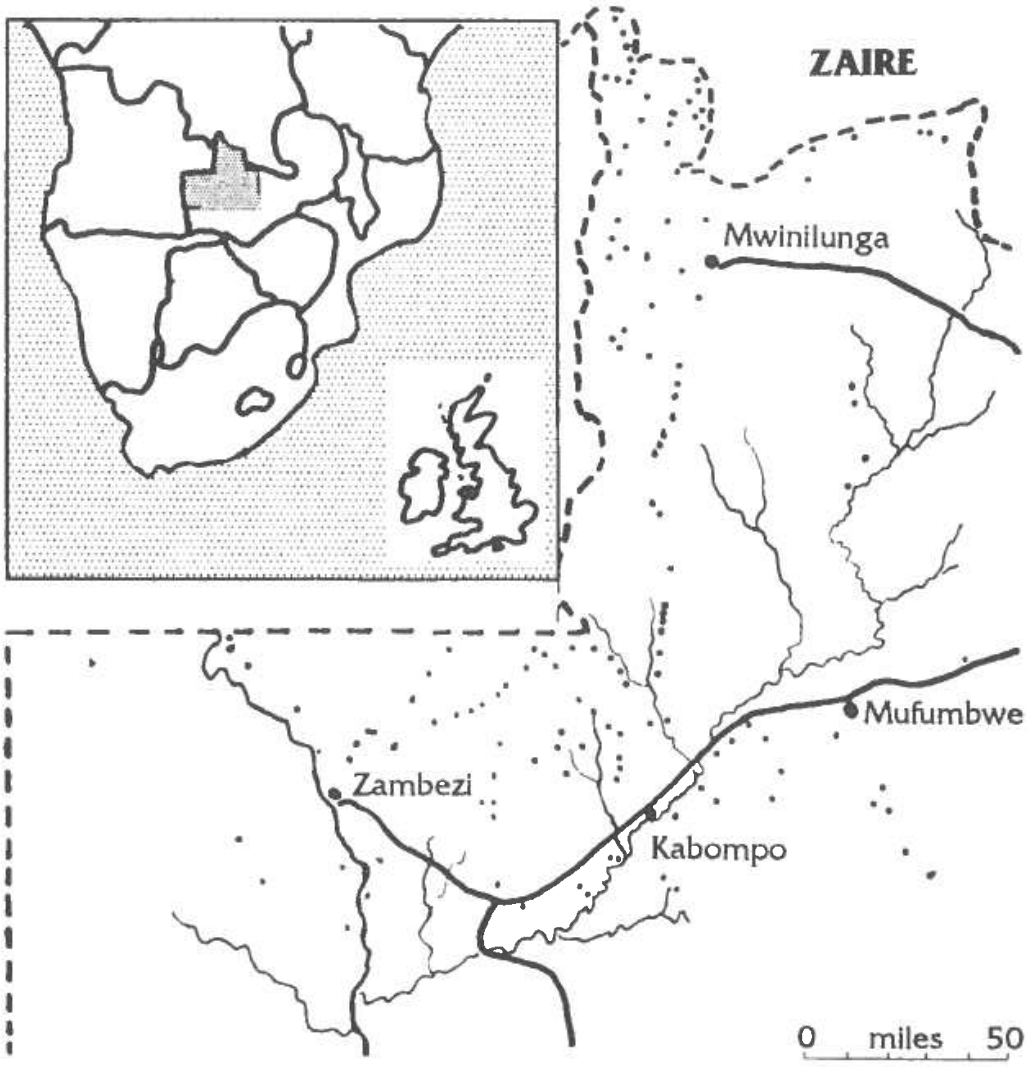
The result is a massive increase in confidence and enterprise amongst the beekeepers and honey and wax production are increasing rapidly. The old 'spoon feeding'-attitude has been replaced by an attitude of responsibility for 'our honey factory'.

Figure 3. The central honey factory at Kabompo

NWBP, some figures

North Western Bee Products Ltd

Project Area;	Kabompo, Mufumbwe, Mwinilunga and Zambezi districts
Total Area;	75,010 sq km
Population (1980);	181,000
Total beekeeping groups;	350 approx.
Total beekeepers registered;	6,000 (they do not all have honey for sale every year)



Map of North West Zambia; Major beekeeping groups are marked with dots. Main roads are marked, beekeeping groups are mostly situated on side roads.

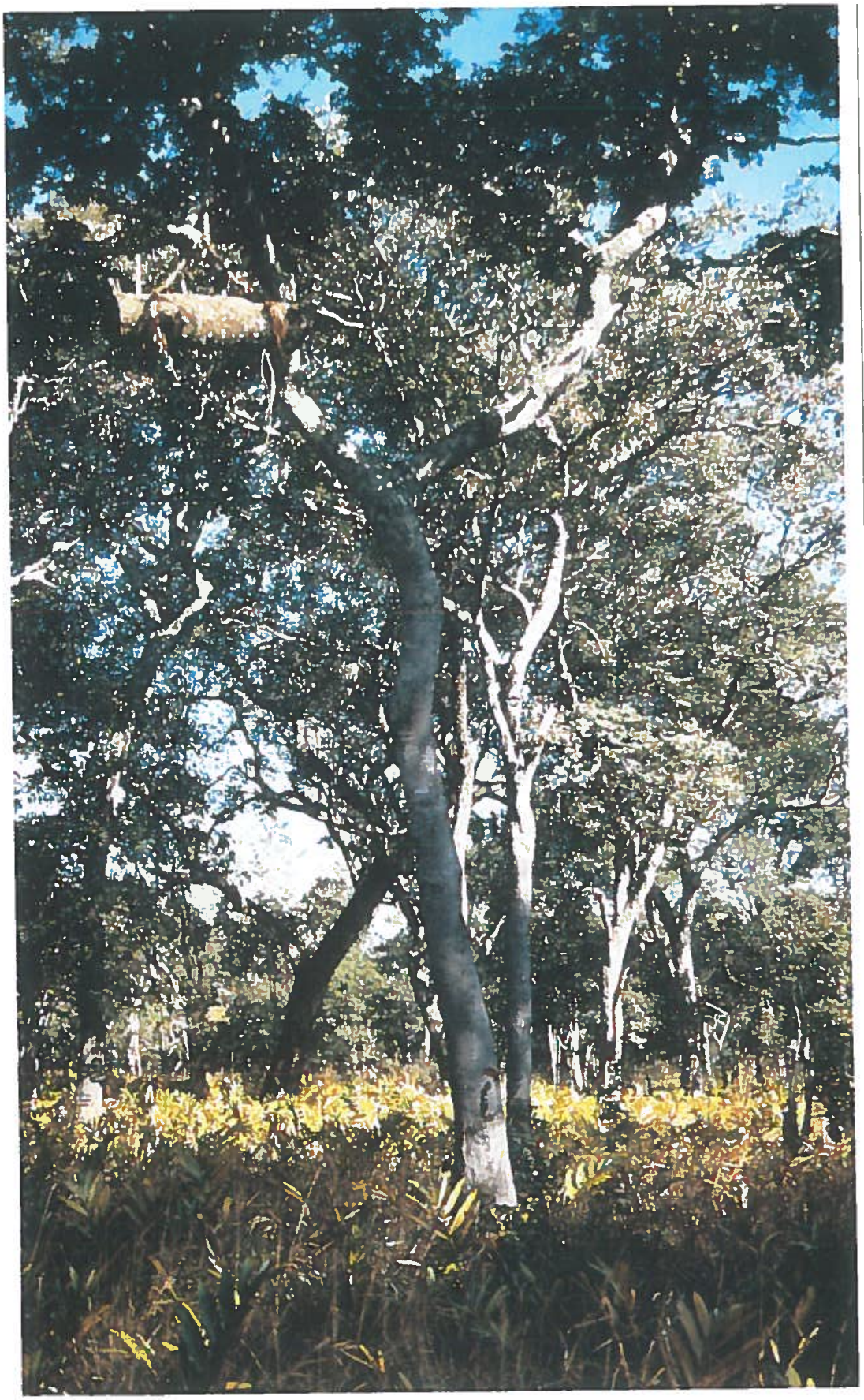


Figure 1. A bark hive hanging up in a tree in the forest of NW-Zambia

Honey and wax production

tons	1985	1986	1987	1988	1989	1990	1991
honey	67	86	80	179	95	175	152
wax	4.5	17	16	29.5	39.5	52.5	52.5

Beekeeping

hives per beekeeper	hives made per year	average crop kg honey /yr	hives cropped /yr	trees cut /sq km/yr
104	26	7.4	7 to 24	1.2
some have over 1,000 hives	bark hives usually last 4 years	most honey is used for brewing beer	varies according to the season	trees for making barkhives

9. Need for cash

Now that the producers have regained confidence in the marketing services available to them, bees and the forest from which the honey is produced have increased in value as useful resources. For the people a source of cash income available in the rural areas is vital in order to halt drift of youth into the cities in search of employment. Since the late seventies many aspects of rural life have deteriorated; essential commodities such as salt, soap, bicycles, clothes have become scarce and expensive and the quality has declined. Government services such as education and health suffer from complete lack of most materials and equipment. Traditional self-sufficiency skills have been lost and many types of wild foods are becoming scarce.

It is this situation which motivates the people to struggle to obtain a little cash in order to purchase essential commodities and to pay education fees. The rural industries offer not just an opportunity to earn cash, they give the population confidence in the continued viability of rural life in a nation where education and culture have been biased in favour of an urban industrial development goal.

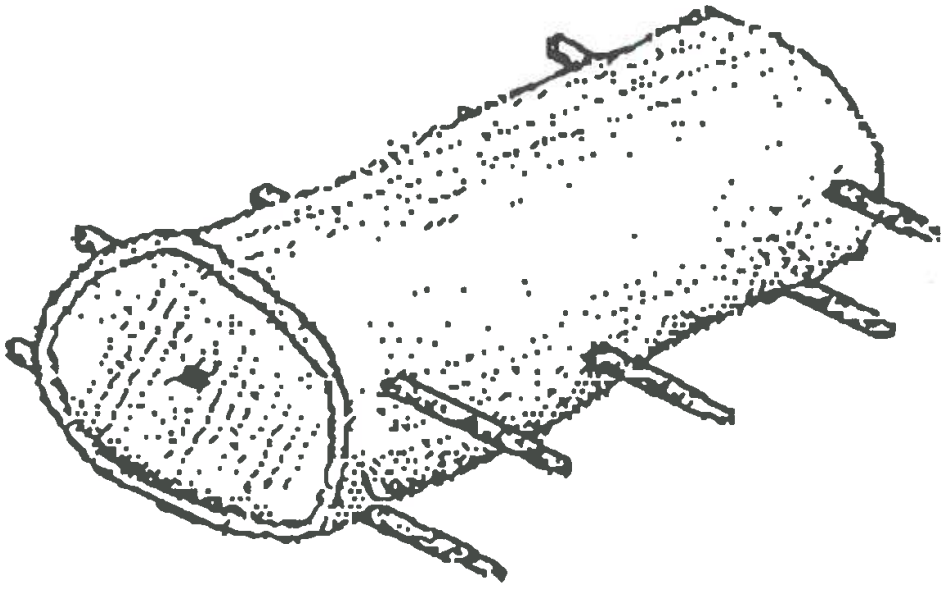
10. Need for export

The economic situation in Zambia is now so difficult that the NWBP has to export honey and wax in order to continue operating. It is not possible to obtain replacements for vehicles and vital

Figure 4. Pressing the honey combs in the factory

Figure 2. A bark hive just after being manufactured

Bark hives have proved to be more profitable to the small scale producer than European designed high and intermediate technology box beehives.



equipment within Zambia. These need to be imported using foreign exchange earned from exports. This in turn brings the problem of very low world market prices, especially for a small organisation such as NWBP. To some extent this international commodity market is being bypassed by NWBP in its attempt to market Zambian honey direct to the consumer. The beekeepers benefit from a higher price and the Western public benefits by having an exciting and unique product available.

11. Future with forest products

From this history and description of the Zambian beekeeping industry several features emerge which are common to many forest products. These are mainly features of traditional forest trading industries out of which developed modern forms of plantation and commercial farming. We have seen in the past that the isolation and small scale of the producers put them in a position of dependency and hence exploitation by the traders.

Does this form a promising base for a renaissance of forest product harvesting which will persuade governments to halt the destruction of rainforests and provide forest peoples with a worthwhile way of life into the 21st century?

Just as the nature of production of the forest harvest lays the producers open to exploitation by the traders, the nature of production also gives them an advantage in the commercial arena. This advantage is that some of these products, for example beeswax, are virtually impossible to produce in larger quantities in a small controlled area. These products can only be produced by thousands of small producers going from tree to tree throughout a vast area of forest. There are undoubtedly new products, and even old products which have been forgotten, that can only be produced in this way.

In order to avoid exploitation either by private traders or state owned marketing organisations, the producers need to organise together to the point where they can take control and ownership of the marketing network, reaching the national or export market. This means that traders will have to compete to buy products from the producers' organisation rather than the isolated producer having to accept the only price that is offered.

12. References and further reading

Clauss, B. & Zimba, R. (1989) Beekeeping development on the base of the existing traditional practices (Zambia - North western Province). In: *Proceed. 4th int. Conf. Apic. trop. Climates*, Cairo, 1988: 168-170

Dubois, L. & Collart E. (1950) *L'Apiculture au Congo Belge et au Ruanda-Urundi. La production du Miel et de la Cire.* Direction de l'agric, de l'elev. et de la colon. Bruxelles, Belgique, 230 pp. (pages 32 - 40 show pictures on the process of making bark hives for South Western Zaire).

Ntenga, G. M. & Mugungo, B. T. (1991) Honey hunters and beekeepers. A study of traditional beekeeping in Babati District, Tanzania. FTP-Programme. Working Paper 161. Sveriges Lantbruksuniv. Uppsala, Sweden.

Villières, Bruno (1987) *L'Apiculture en Afrique. Le Point sur... Dossier 11.* (Fig. 86, p 105) GRET, Paris, France.

Wainwright, D. (1989a) Beekeeping at the integrated rural development programme, Kabompo, Zambia. In: *Proceed. 4th int. Conf. Apic. trop. Climates*, Cairo, 1988: 198-201.

Wainwright, D. (1989b) Socio-Economic Comparison of Beekeeping technologies in Zambia. In: *Proc. 4 int. Conf. Apic. trop. Climates*, Cairo, 1988: 360-366.

Wainwright, D. (1989c) Appropriate beekeeping technology in Central Africa. Newsletter 14 May 1989. IBRA, Cardiff, UK

Skep beekeeping in the Netherlands

Jaap Duijvetter (revised by J. Beetsma)

1. Introduction

Traditional beekeeping is not restricted to the (sub)tropical climates or to developing countries. Some hundred years ago the majority of Dutch beekeepers kept their colonies in skeps. Nowadays, skep beekeeping is still carried out by a few professional beekeepers and numerous amateur beekeepers. Thus, the knowledge of and experience with skep beekeeping is still present. Skep beekeeping, as it was conducted in the past, and its relationship to agriculture and sheep-breeding in the Netherlands will be described in this article.

2. Materials used to make skeps

Skeps were made of different materials, depending on the region. For example, the nodeless stems of 'pijpestrootje' (purple melic-grass/lavender grass/Indian grass; *Molinia coerulea*), rye straw or withes (twigs of the willow tree) were most frequently used. Sometimes the stronger and thicker heather straw was used. This material was bound into thumb-thick, firmly twisted bundles using lengthwise-split blackberry stalks. To split these stalks a triangularly carved piece of pockwood (*Lignum vitae*) was used. To obtain a bundle of the desired diameter, the bundles were passed through a ring cut from a cow's horn or bone. Twigs of the alder buckthorn (*Frangula alnus*) were used to make skewers (Figure 1, see page 40). Skeps were usually covered with dung, loam or a mixture of both to make them more weather-resistant.

The shape of the skep also varied between the regions. These skeps were generally dome-shaped; however, the so-called 'Bisschopsmuts' (Bishop's hat), a miter-shaped basket made of withes and covered with grass (Figure 2, see page 41), was also used. Some skeps were decorated. For example, an angry-looking face painted on the

Figure 1. View of the underside of a skep. The parallel combs and two skewers are visible.

outside of the skep was believed to ban evil spirits. Roman Catholic bee-keepers sometimes put a cloak in the shape of St. Ambrose over the skep, believing that this protected their bees.

3. Cultivation of the country

About thousand years B.C. more permanent settlements were established. Man started farming, including the cultivation of crops like barley, oats, wheat, spurry, white clover and turnip. In the meadows dandelion and clover were found, while on somewhat higher sandy soils villages were surrounded by fields and meadows. Beyond these villages sheep were led to large common grazing fields. Trees were absent in these fields due either to periodical burning, or, once the field was bare enough, to the grazing of young tree shoots by the herd.

Heather could resist such a harsh regime and thus became the major species in these fields. Heather sods were used as litter in the sheep folds. The mixture of these sods and sheep dung were of major importance for the fertilization of the fields. There are examples in the Netherlands of fields with sandy humus layers, 1. 5 m thick, illustrating that sheep dung and sods were used as fertilizers for hundreds of years.

In the lowest parts of the country dams and dikes were constructed, inside which cattle and grassland farming, combined with field crops, took place. Major crops were cereals, rapeseed, buckwheat, and, after Columbus' discovery of America, potatoes. In some areas in the river delta, fruit growing became also widespread.

4. Heather beekeeping and migration

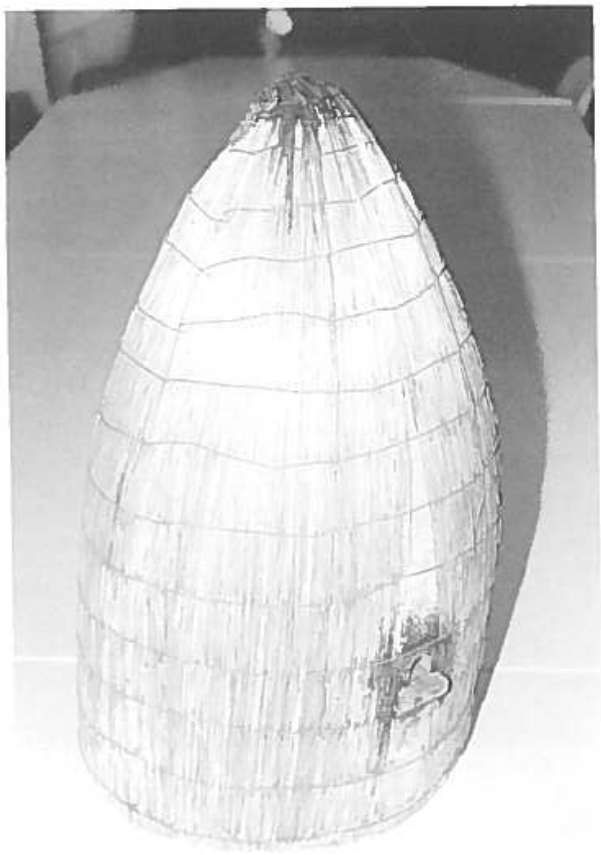


Figure 2. 'Zwanehals'-skep (Swan's neckskep). Made of the same material as the 'Bisschops-muts'-skep (or miter-shaped skep).

The large heather areas were of major importance to beekeeping and were conserved as long as sheep herds were kept. Many farmers of the higher sandy soils also became beekeepers for the supplementary income. This form of agriculture gradually disappeared with the introduction of artificial fertilizers.

After the willow forage, the beekeeper migrated his colonies from the sandy soils to the fruit trees and rapeseed fields in the clay soil areas. After a large honey flow the combs containing honey at the side of the brood nest were collected from the skeps. In July the colonies were brought back to the heather areas.

5. Beekeeping methods

After the winter bee colonies were fed with 'stamphoning', a mixture of honey, pollen and wax. This mixture was made the previous year by crushing and pressing combs, that contained honey and pollen.

The first nectar of the year is produced by willow trees, flowering from March to May. During this period the beekeeper tried to obtain strong colonies of the same size by feeding a sugar solution and regularly changing the position of the skeps. In addition, bees were collected from strong colonies and introduced into weaker ones. To collect the bees a plate containing a sugar solution was placed under a skep with a large colony. When this plate was covered with many feeding bees, it was placed under a skep containing a

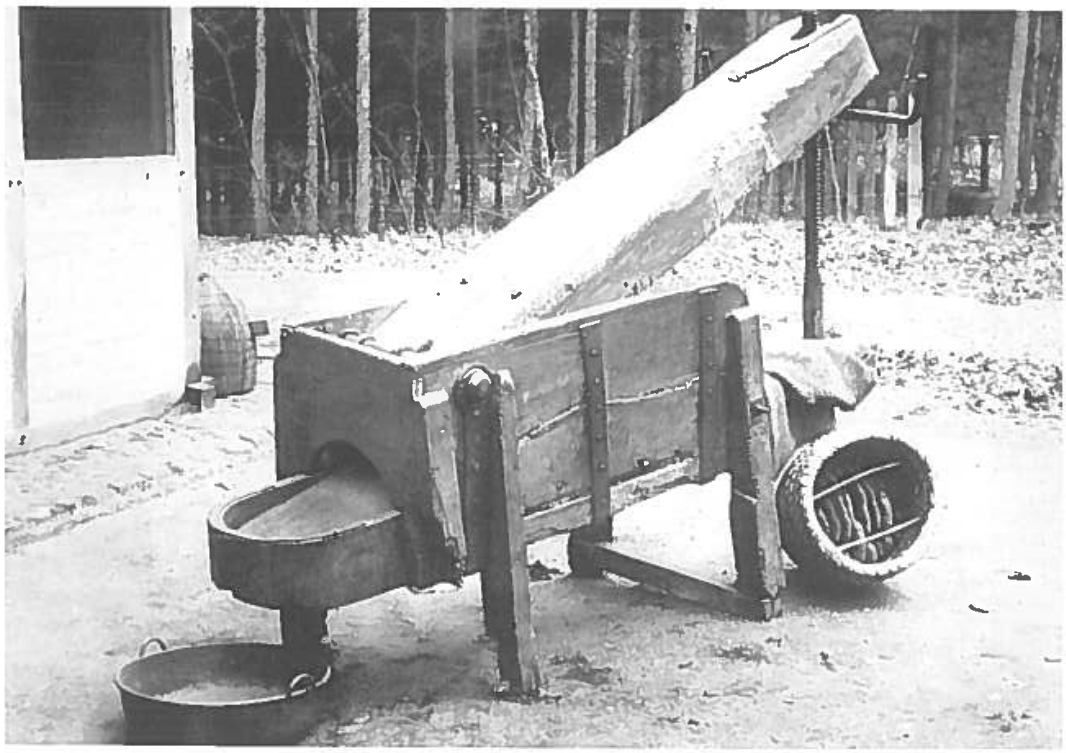


Figure 3. Wooden honey press (collection of the Dutch Open Air museum, Arnhem).

smaller colony. In this way a large number of colonies were stimulated to produce swarms in May and June. The beekeeper collected these swarms in a 'kieps', a small skep.

By keeping equally strong colonies the beekeeper tried to force each colony to produce a prime-swarm in the same one-week period. The following week, after prime-swarming, after-swarms were collected. The beekeeper tried to synchronize swarming to prevent the after-swarms from joining the prime-swarms, which would lead to fighting among the two types of swarms.

The prime-swarm was then put into a clean empty skep. The beekeeper had already attached small pieces of comb at appropriate intervals and in the wanted direction in the top of the skep. The bees then build new combs. In this way the large prime-swarm would not be troubled by diseases or parasites and would develop well during the summer, foraging on clover, lime-tree, corn-flower and buck-wheat. In many cases colonies, that had developed from prime-swarms, were also moved to the heather fields.

6. Prevention of after-swarms

The beekeeper tried to prevent the occurrence of after-swarms from

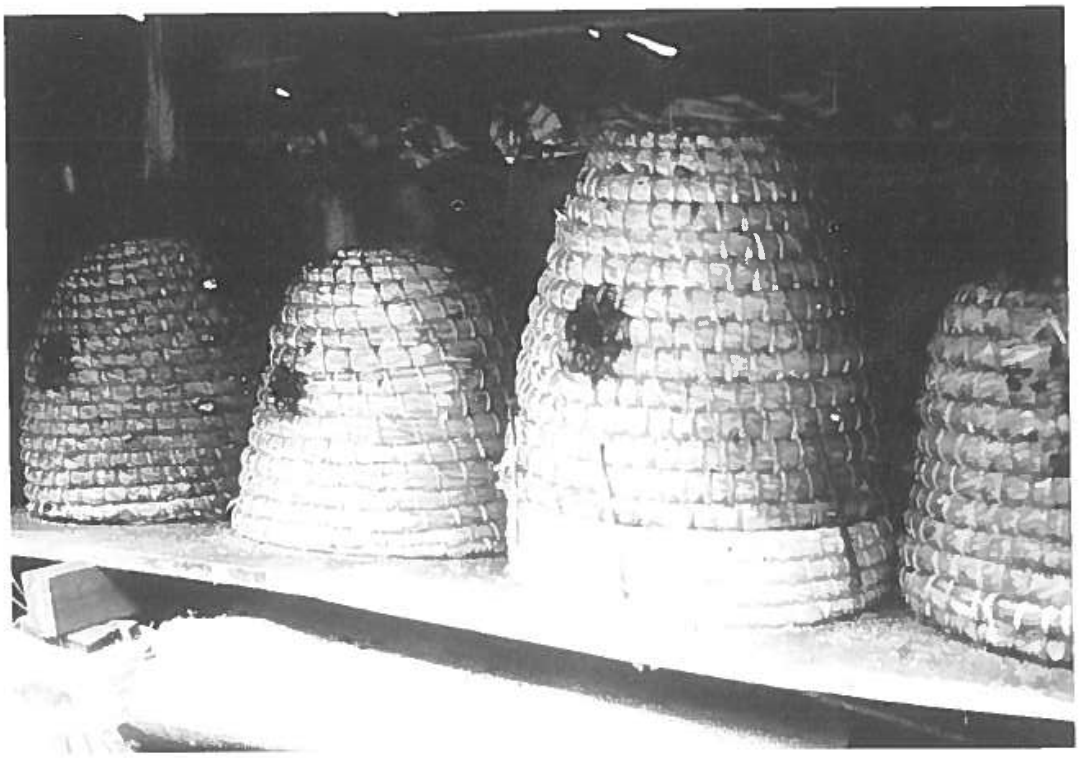


Figure 4. Skeps on a row. One contains a lower extension, an 'eke'.

colonies headed by old queens, by changing the position of the skeps, thus distributing the foragers over other colonies, or by expelling the bees from the skep by continuously tapping the upside-down skep, while keeping an empty skep on top of it. In this way the bees in the lower skep, disturbed by the tapping, entered the empty one. The tapping could be done gently with the full hand or with a stick, moving slowly from the top to the base of the skep. Such expelling or driving must be done in the early morning and in absence of a nectar flow. Driving in the wrong way or at the wrong moment results in a mess of honey, bees and combs.

The second swarm, being the first one with a virgin queen, was likewise put into a new skep or put back into the skep from which it came, depending on the size of the colony or the time of the year. The beekeeper, therefore, had to know from what skep the swarm had left. The after-swarm usually left the skep one week after the prime-swarm. By listening to the skep the beekeeper could hear the high piping sound ('tuten') of a newborn queen and the lower piping ('kwaken') of her not-yet-emerged sisters.

If the beekeeper wanted to prevent after-swarms without reducing the size of the colony, he would pin a cloth at the lower open part of the skep. Then he would turn the skep upside down and, by

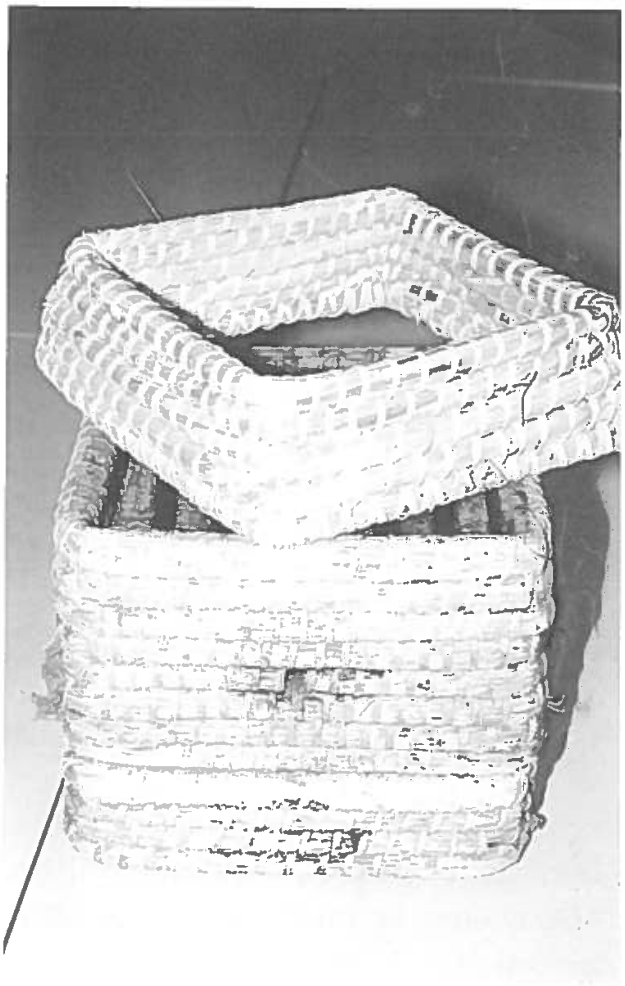


Figure 5. A square skep from Uddel with an 'eke' super on top.

tapping on the wall of the skep, drive the colony towards the cloth. All the mature piping queens had by this time emerged from their cells. Finally the skep was bumped on a sack filled with straw, killing the queen pupae still inside their cells. The skeps were then left overnight in this upside-down position, with the emerged queens fighting. The next morning the swarming tendency was usually over, and the skep was placed back in its original place and position.

7. *Honey harvesting*

Two methods of honey harvesting were used. The first one was to kill the bees with sulphur: The beekeeper closed the skep by pinning a cloth on the underside and then placing the skep on top of a hole in the ground, in which sulphur was burnt. After removing the cloth with the dead bees, the skep was then bumped on the ground on one side to loosen the combs.

The second, much more elegant method was to drive the colony into an empty skep, as described above. The honey combs and brood combs were then separated, the latter being stored overnight in a warm moist place. The bees, in the meantime, were kept in the empty skep, laying on its side. All combs were removed from the skep. Combs containing e. g. liquid buckwheat honey were pressed and sieved through a piece of cloth. Combs with heather honey had to be pressed. For this purpose various kinds of heavy wooden honey

presses were used (Figure 3, see page 42). The next morning the brood combs were fixed in an empty skep using skewers to attach them in the right places. The bees were then introduced. These colonies were fed a sugar solution to prepare them for the winter season. No honey was taken from skeps weighing 12.5 - 15 kg. Colonies of this size were kept intact to hibernate and thus provide the best starting material for the next spring.

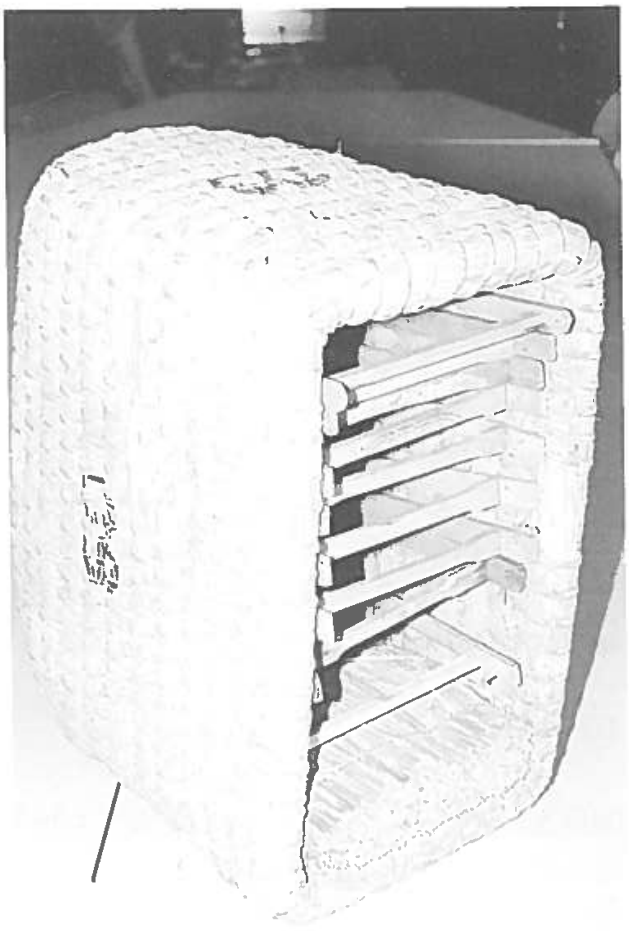


Figure 6. 'Gravenhorster boogkorf' containing movable frames.

8. Transitional stages between skeps and hives

Beekeepers in the little village of Uddel, in the Veluwe (the central part of the Netherlands), started using square skeps, quite similar in shape to the square skeps used in the Lüneburg heather fields in Germany. It was common practice with the normal dome-shaped skeps to place 'ekes', supplementary connected compartments, under the skep during the honey season (Figure 4, see page 44). However, the beekeepers in Uddel used ekes as a super on top of the skep (Figure 5, see page 44). Later, movable frames or top bars were used in eke supers.

Afterwards an arched skep with movable frames was developed by C.J.H. Gravenhorst (1823-1898) in Germany (Figure 6, see page 45). This skep was then followed by square hives made of straw and wood or wood and reed or only wood and finally by modern plastic hives.

9. Further information

Various types of skeps and skep beekeeping equipment are exhibited in the Dutch Open Air Museum, Schelmseweg 89 in Arnhem, telephone 085-452065

The skep market in Veenendaal dates back to the 1850s. Skeps with swarms are sold on the 3rd Tuesday of July every year.

The following films can be ordered from: Institut für den Wissenschaftlichen Film, Nonnenstieg 72, 3400 Göttingen, Germany, telephone 0551-2020:

E 2661 Wachspressen in einer Imkerei (wax extraction)

E 0394 Flechten eines Bienenkorbes (making a straw skep) and

E 2790 Herbstarbeiten in einer Korbimkerei (work in a skep apiary in autumn).

10. Further reading

Jan van de Veluwe (J.J. Speelziek) (1982) Korfimker, eens een beroep thans een hobby. (Skep beekeeper, once a profession, now a hobby.) Bijenhuis Wageningen, Netherlands

Traditional beekeeping with stingless bees in Meso-America

Marinus Sommeijer

1. Introduction

Beekeeping with stingless bees (Apidae, Meliponinae), called 'meliponiculture', has been practiced for many centuries in various parts of Latin America. The honey of these bees has always been used as food and medicine by pre-Columbian indians in Central America. This form of beekeeping was an economically very important tradition in the Maya culture (Wagner, 1960; Weaver & Weaver, 1981). It is still widely being practiced.

Although stingless bees, just like the honeybees, *Apis mellifera* (Apidae, Apinae), can be domesticated and be used for the production of honey and wax, they are taxonomically very different from the well known honeybee. There are even more differences between stingless bees and honeybees, than there exist between bumblebees (Apidae, Bombinae) and honeybees (Winston & Michener, 1977).

The honeybee did originally not occur in the Americas. However, after the discovery of the new world, colonies of European *Apis mellifera* were introduced. Apiculture with these introduced honeybees, was developed in Canada, the United States, Mexico and many Latin American countries. Thus, also in tropical America, beekeeping was developed utilizing bees, technology and biological know-how, from temperate regions. Their excellent flora made Mexico and other tropical American countries become major honey exporters.

In contrast to this development, the traditional beekeeping with the less productive indigenous stingless bees, obtained gradually the status of a primitive enterprise (Nogueira Neto, 1951 and 1970). Recently however, Meliponiculture is receiving great attention in Central America. This is the result of the spectacular spread over South and Central America, of aggressive African honeybees which

Meliponi culture in Yucatan: Hive with cross-shaped decoration above the opening.

Figure 1. Meliponi culture in Yucatan: ritual offering of honey, after the harvest.

Extraction of honey.

were introduced into Brazil in 1957 (Michener, 1975). These bees crossed the Panama Canal in 1982 and have now spread over Central America and Mexico. Easily mixing and, at colony level, very competitive with domesticated honeybees, they are quickly replacing gentle varieties of *Apis mellifera*. The 'defensive behaviour' of these bees is very much feared, and beekeeping with such 'killerbees' has become very difficult (Sommeijer & Van Veen, 1989).

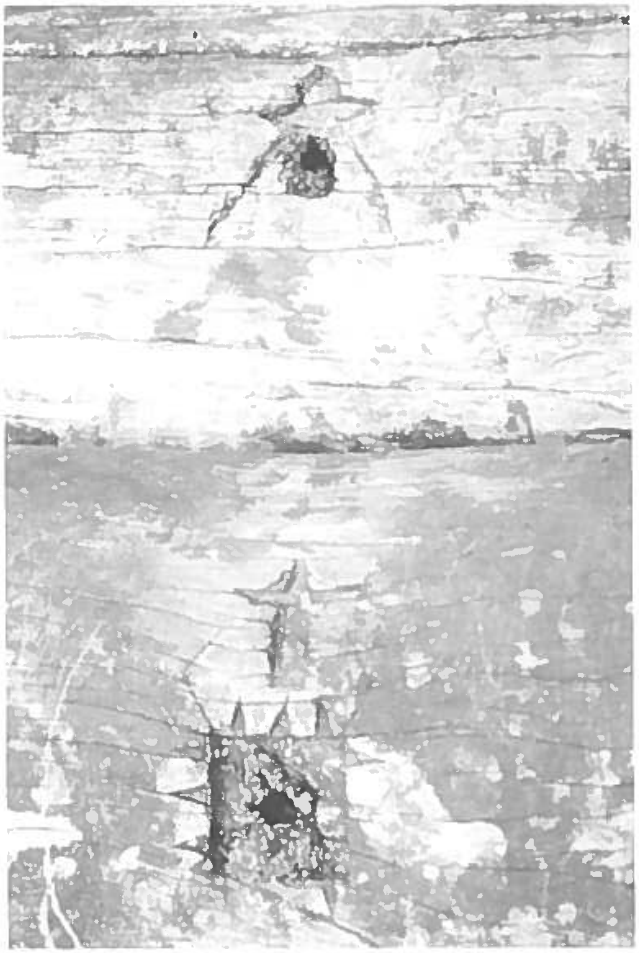
The introduction of the 'Africanized' strains of *Apis mellifera* has reduced the interest in apiculture with honeybees: the aggressive nature of these bees is causing various problems. However, the 'Africanized' strains proved to be very successful in founding feral colonies in nature where they are competing with the indigenous stingless bees, of which many have similar floral preferences. Domesticated colonies of stingless bees are reported to suffer from competition from 'Africanizadas'. Africanized honeybees may be more successful because of the following:

1. their larger colony size; 2. a more efficient recruitment system; 3. a prolific social reproductive ('swarming') behaviour; 4. a larger body size compared to most stingless bees, which implies a larger flight range.

As a good alternative for small scale apiculture with aggressive honeybees, the local traditional 'Meliponiculture' is presently being studied and improved.

2. Ecological importance of stingless bees and the present status of meliponiculture

The stingless bees are very numerous in species (about 500) and individuals in tropical America, Africa and South-East Asia. Their geographical distribution is restricted to the tropics. Different theories exist concerning the region of their origin and their subsequent geographical distribution. Wille (1983) hypothesized an origin and subsequent dispersion from Africa. Other theories claim an origin in the present neotropical continent. Stingless bees are especially diverse and abundant in tropical America, where all taxonomical groups are represented. They are the most important pollinators of the tropics (Nogueira Neto, 1970; Wille & Michener, 1973; Michener, 1973).



Hives with cross-shaped decorations above the opening.

Various indigenous species are still domesticated in all central american countries. But 'Meliponiculture' is nearly always very inefficient. Due to the ignorance of their social behaviour there is no proper technology.

Honey is frequently collected from natural colonies in the forest. This leads often to the destruction of the nests. Domesticated colonies are mostly housed in an inefficient way in old logs and sometimes even in cardboard boxes. The owners have no knowledge about the natural multiplication of their colonies. During the harvest the foodstores are removed from the nest. The honey is squeezed out of the large storage pots which are built in compact clusters. Since honey pots are mixed by the bees with pollen pots, there is in general a considerable amount of stored pollen lost during these operations. Due to the difficult accessibility of the nest cavity in the bee logs, with only narrow openings at the ends, a part of the brood may be destroyed when the honey is taken out. This makes that colonies suffer badly from the harvest. Only after a long recovery they will start to produce again an excess of food.

In Costa Rica, certain regions are well known for their traditional meliponiculture. Of special importance is the area around Nicoya in Guanacaste. This region was already named by the first Spanish settlers as a 'tierra de la miel' (=land of honey). Wagner indicated in 1958 the incidence of this primitive type of beekeeping (meliponiculture) in this area of Costa Rica as follows: „One of the most characteristic features of the rural household in Nicoya is the bee log

Maya-god, Ah Musen Kaab.

Advertisement for 'dia del campo' for traditional meliponiculturists.

which hangs under the eaves of the dwelling... Almost every house in the country hamlets and many of the dwellings in the towns have such logs".

3. Local and regional nomenclature for stingless bees

In Central America stingless bees are called 'jicotes'. The traditional great value of these bees to the local people, is indicated by the rich nomenclature for these insects in all regions (Gonzalez Acereto, 1984). The many common names that are used in Costa Rica are imaginative and sometimes vulgar: eg. Jicote gato, Barcino, Maria-Seca, Mariquita, Cacho Venado, Tamaga, Congo, Culo de Senora, Culo de Vaca etc.

4. Two types of meliponiculture

There are roughly two types of meliponiculture:

a. the domestication of *Melipona* in Costa Rica

A colony of these bees can produce various liters of honey per year. The most important species is *M. beechii*, 'el jicote gato', which is

Meliponiculture in Yucatan: Colmenar and its owner.

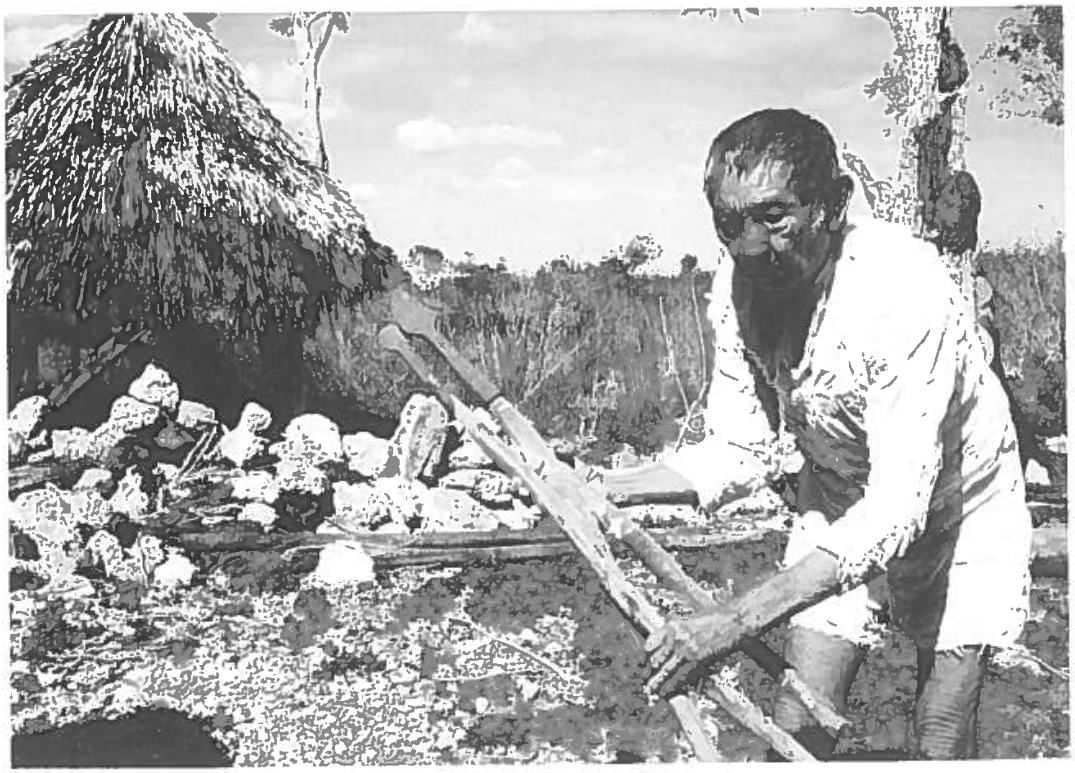
commonly domesticated in the peninsula of Nicoya and the part of Guanacaste north of Puntarenas. It is still most common in areas with nearby forest. Little of this meliponiculture is found at altitudes above 700 m.

In the area of Perez Zeledon colonies of a dark variety of the species *Melipona fasciata*, called 'el jicote barcino', are being kept.

Most owners keep their 'jicotes' in logs, hanging under the roof of the house or under special roofings. The same hives are being kept for many decades by subsequent generations of the family, living in the same house. All campesino families consider their 'jicotes' as very valuable domestic animals.

It is very interesting that the amount of honey that is produced, is said to depend to a large extent from the size of the cavity of the log. Trunks with a narrow cavity produce less honey than logs with large hollows.

It is stated that the bees do not accept new homes and the owners are always reluctant to transfer a nest to a new housing. However sometimes an extension of the nest cavity of a trunk is created by connecting an empty log to a trunk with a nest. The apparent negative opinion concerning the transfer of *Melipona* nests to boxes, relates most probably to the severe attack by phorid flies (*Pseudohypocera sp.*) in boxes that are not properly sealed.



Ancient meliponi-culture tools.

b. the domestications of *Trigona*

In Costa Rica, this type of meliponiculture occurs throughout the country, also at higher altitudes and even in urban areas. Especially the nests of the minute *Tetragonisca* are frequently kept in small boxes, or in bamboo pipes. These nests produce far less honey: only up to one litre. In certain parts of the country nearly every house of the village has such small hives! It is not exceptional to find 20 hives hanging on the walls all around the same house.

Tetragonisca angustula is also commonly domesticated along the coastline of El Salvador, probably not above an altitude of 400 m. The nests of this bee, locally called 'Chumela', are traditionally kept in 'jicaros' (gourds). The honey of this bee is also in El Salvador very highly priced. The use of this particular honey is even 'documented' in various traditional songs in El Salvador. As the title indicates, this bee is the major subject of the traditional 'Himmo de Chumela'. The local name of this very common bee in Guatemala is 'Doncella'.

5. Traditional beekeeping with stingless bees in Yucatan, Mexico

Yucatan is still the most important meliponiculture region of

Mexico. The importance of meliponiculture for the traditional Maya culture is reflected in ancient Maya ornaments and sculptures, e.g. the incense altar for the Maya god of the stingless bees, Ah Musen Kaab.

The recent introduction of 'Africanizadas' in Yucatan (Africanized bees have invaded Yucatan only in 1987) is responsible for the recent great interest for the improvement of the traditional meliponiculture.

Meliponiculture is still of economic importance in Yucatan. Traditional meliponiculture has been described by various authors, eg. Weaver and Weaver (1981). Many visited traditional meliponiculturists stated clearly that they would never turn to apiculture (beekeeping with honeybees) because of the feared stings and also because of the fact that meliponiculture is a rewarding enterprise.

Meliponaries (bee stands with a number of hives of stingless bees) are different from those in Costa Rica. In Yucatan they consist of a shed, covered e.g. with palm leaves, under which the 'jombones', the hollow trunks that serve as a housing for the nests of stingless bees, are stacked. Stingless bees are very productive in Yucatan. About four to five harvests may be possible during one season. Each colony, still kept under primitive conditions, may produce about five liters per year. The local (Maya-) names for *Melipona beechii*, for centuries the most commonly domesticated species, are 'Xunaan Kaab' and 'Koole Kaab'.

The owners use very old traditional instruments for excavating the hollow cavity in the 'jombones' (like those for making 'wooden shoes' in Holland). An important fact for the owners is that the very extracting of the honey, in various regions of the peninsula, should be performed by a woman. This lady, 'la encargada de la sacada de la miel', may be assisted by other members of the family during the harvest operation. This is in sharp contrast to the situation in Costa Rica, where in certain areas it is said that 'Jicote gato' (*M. beechii*) should not be touched by women.

Most meliponaries in Yucatan consisted of a number of about ten 'jombones'. However some contained several times this amount. Most owners stated that in the past their meliponary had been much bigger.

6. Biological backgrounds for traditional hive decorations

The 'Jombones' are always placed in a horizontal position and have the exit hole centrally. In general there is an interesting carving just above the exit hole, mostly in the form of a decorated cross. This decoration is said to have a religious function. Many rites and ceremonies are still associated with meliponiculture in this region. However, when participating in a harvest procedure at a meliponary where the 'jombones' did not have such decorations, I noticed that there may be a very important function of this decoration, related to the biology of the bees. During the harvest, both ends of the cylindrical 'jombon' are opened by removing the wooden disks that serve as stoppers. When closing the hive, these disks are replaced and the cracks are sealed thoroughly with wet red earth.

I observed that the cylindrical 'jombon' became smeared all over with this red earth during the sealing, after which it was put back on the stack. At the moment it appeared difficult, because of this smeared appearance of the jombon and because of the absence of carvings above the entrance hole, to determine precisely which side had been the top of the horizontal 'jombon' when it had been taken off from the stack. Obviously, when the cylindrical 'jombones' are not marked with such carvings, it will be difficult to ensure that the 'jombon' is in the proper position when it is placed back on the stack after treatment. The biological consequences may be clear: a broodnest placed in an upside-down position after the harvest, suffers considerably because of the loss of all the young brood that drowns in the liquid food in upside-down horizontal combs. The conclusion is that at meliponaries where the jombones are marked, no errors can be made when the jombones are returned at the stack. This must 'selectively' have led to significantly higher yields in 'decorated' jombones.

7. Attributed medicinal properties of stingless bee honey

Especially to the honey of the small *Trigona* bees, great medicinal properties are being assigned. This honey is sold at a high price. Some producers sell this honey as a medicine to local pharmacies. In El Salvador as in the other countries there is a widespread use of this

honey as medicine, especially against cataract. This particular application is very common in all countries of Meso-America.

The Maya indians in Yucatan still discriminate between more than ten species of stingless bees, especially for the medicinal use of their honeys (Gonzalez Acereto, 1984). The backgrounds of these attributed medicinal properties have not been studied, but there are indications for antimicrobial effect. It seems important to study these attributed medicinal properties.

8. Economic status of traditional meliponiculturists

The people who are keeping stingless bees belong to the low-income campesino group. For these families this side-line enterprise is of great economic value, because of the additional income of very healthy and tasty food and the cash obtained from the honey.

In addition to their economical benefits, the bee logs attribute other values to the house and the owners appear very reluctant to sell their hives.

9. Conclusions

The development of traditional meliponiculture offers new possibilities for the people in rural areas, e.g. women, and will improve the economics of many households. Many people that are now backing out of beekeeping because of the aggressiveness of the 'killer bees' may be able to take up meliponiculture. An improved rationalized management of domesticated colonies, based on the biology of the bees, will increase honey production. Various aspects of the traditional meliponiculture, e.g. the housing of colonies, multiplication and harvest procedures, offer promising factors for improvement.

In areas with Africanized honeybees these should be kept away from the inhabited areas and here stingless bees are perfectly to be used in the yard ('Apis afuera, Melipona en el solar'). Meliponiculture should not replace the beekeeping with honeybees, but should be developed as an economically important complementation of beekeeping in Meso-America.

10. References

Darchen, R. (1973) En pays Maya: Les Melipones. *Revue Francaise d'apiculture* 307: 123-126

Gonzalez Acereto, J.A. (1984) Acerca de la regionalizacion de la nomenclatura maya de las abejas sin aguijon (*Melipona spp.*) en Yucatan. *Rev. Geografia Agricola*, 5/6:190-195.

Gonzalez Acereto, J. A. (1984). Historia de la Meliponicultura. *Rev. Aut. Yucatan* 89-92.

Michener, (1975). The Brazilian Bee problem. *Ann. Rev. Entomol.* 20:399-416.

Nogueira Neto, (1970). *A criação de abelhas indígenas sem ferrão.* 2a Edição revista, São Paulo, Chácaras et Quintais. 365 pp.

Nogueira Neto, (1951). Stingless bees and their study. *Bee World* 32:73-76.

Sapper, K. von, (1936) Bienenhaltung und Bienenzucht in Mittelamerika und Mexico. *Ibero-Amerik.* Arch. 9:183-198.

Sommeijer, M. J. (1983). *Social mechanisms in stingless bees.* PhD Thesis, Utrecht University, pp 147.

Sommeijer, M.J. & M.C. Bootsma (1988) *Melipona trinitatis* comme productrice de miel a l'ile de Trinidad, Antilles. *Actes Coll. Insectes Sociaux*, 4:291-294.

Sommeijer, M. J. , De Rooy, G. A. , Punt, W. A. and de Bruijn, L. L. M. (1983). Comparative study of foraging behavior and pollen resources of various stingless bees (Hym., Meliponinae) and honeybees (Hym., Apidae) in Trinidad, West-Indies. *Apidologie* 14(3):205-224.

Sommeijer, M.J. and van Veen, J.W. (1988) 'Killerbees' of wonderbijen: een recente visie op de introductie en verspreiding van Afrikaanse honingbijen in tropisch Amerika. Deel 1. *Bijenteelt* 90 (11):310-311 en Deel 2. *Bijenteelt* 91 (1):10-12.

Wagner, H. O. (1960) Haustiere im vorkolumbischen Mexico. Z. *Tierpsych.* 17: 364-375.

Wagner, Ph. L. (1958) Nicoya, a cultural geography. *Univ. of California publ. in Geography* 12(3):195-250.

Weaver, N. and Weaver E. C. (1981) Beekeeping with the stingless bee *Melipona beechii*, by the Yucatan Maya. *Bee World* 62 (2):7-19.

Wille, A. (1979). Phylogeny and relationships among the genera and subgenera of the stingless bees (Meliponinae) of the world. *Rev. Biol. Trop.* 27:241-277.

Wille, A. (1983). Biology of the stingless bees. *Ann. Rev. Entomol.* 28:41-64.

Wille, A. and Michener, C.D. (1973). The nest architecture of stingless bees with special

reference to those of Costa Rica. *Rev. Biol. Trop.* (San Jose, Costa Rica) 21: Suppl. 1; 1-278.

Winston, M. and Michener, C. D., (1977) Dual origin of highly social behavior among bees. *Proc. Nat. Acad. Sci. USA* 74: 1135-1137.

Sommeijer, M. J. van Veen, J. W. and Sewnar, R. (in press) The intranidal activity of males of Melipona with some remarks about male production in stingless bees. *Actes Coll. Insectes Sociaux*.

Van Veen, J. W., Arce, H. and Sommeijer, M. J. (in press) Production of males in colonies of *Melipona beechii*, Costa Rica. *Actes Coll. Insectes Sociaux*.

Traditional beekeeping using *Apis cerana* in Vietnam

Vincent Mulder

I. Introduction

The urgent question of how to increase the income of rural population in developing countries has led to the promotion of various types of small-scale income-generating activities. One of such activities is beekeeping. In Vietnam for example the economy is now gradually becoming liberalized and unemployment is increasing rapidly among the farmers who make up about 80 % of the population. Because of this increase in unemployment beekeeping is becoming more and more attractive as side-line work. The art of beekeeping however is not new to Vietnam. It has always been practiced in the traditional manner all over the country, which facilitates its spread to more members of the population.

In several other Asian countries, attempts at making apiculture a widespread economic activity have failed horribly. Reasons for this can be found in the choice of the bee species (often the imported *Apis mellifera*) and in the technology used. For instance, in almost all of these beekeeping development programs frame hives and a western style of bee management were used.

Using Vietnam as an example, this paper will show there is a broad basis of traditional bee management with the Asian bee *Apis cerana*, upon which new beekeeping systems can be suitably developed for smallholders.

II. Present beekeeping status

National Vietnamese honey production amounts to an estimated 1,500 tons per year, most of which is produced by full time professional migratory beekeepers using frame hives. Until recently these were organized in collective units, under a complete state-run jurisdiction.

Frame-hive beekeeping was first introduced about 1930 by a French colonizer in the north, using an *A. cerana* colony (J. G. C., 1933). In 1948 a French priest was the first to import *A. mellifera* in frame hives in the south (Masse, 1948). However it was not until the early 1960s under the socialist government, that frame-hive beekeeping was widely developed with both species, mainly using techniques practiced in China. Futhermore it is only due to this frame-hive beekeeping that export of over 400 tons anually is now possible.

Before frame-hive beekeeping was introduced, various techniques of honey and wax production had already been developed and are still used today. *A. dorsata*, the 'rock bee' or 'giant bee', was the main producer of honey and wax before the introduction of *A. mellifera*, with exports of honey and wax being reported even before 1900 (Fougères, 1902). Part of this honey was produced by groups of foresters in the southernmost part of the country, who used special management techniques for attracting colonies which then lead to periodical harvests. This type of traditional management still exists today (Crane et al, 1991). *A. dorsata* honey is still obtained by hunters or collectors, who either harvest once and then destroy the nest completely or cut parts out of the comb during several harvests. In some regions such deliberate sequential harvesting is also practised for the smallest honeybee species, *A. florea*. Together with *Trigona* spp. (stingless bees) this tiny honeybee provides minor sources of honey. At present some beekeepers have started keeping stingless bee colonies in hives around their houses. This honey, even though obtained in small quantities, is expensive at the local market due to its curative effects.

III. Traditional management of Apis cerana

The most diversified bee management systems with *A. cerana* have developed in the northern part of Vietnam in the former province of Tonkin. Toumanoff and Nanta (1933) revealed that in the early decades of this century some families in almost every village in the north were keeping a small number of colonies in hives around their houses. However, no full time or professional beekeeping was reported, nor were any frame hives used by the population at that time.

Today this local small-scale beekeeping still occurs alongside the professional migratory beekeeping.

Although we do not have information as detailed as that presented in 1933, it seems that traditional beekeeping has decreased or even disappeared in some areas, while in other regions it still exists as described by Toumanoff and Nauta (1933). The main reason for this disappearence is probably the severe deforestation that has occurred in Northern Vietnam during the past few decades.

Unlike migratory beekeeping that seeks flowering monoculture vegetations and mainly relies on agriculture, small-scale stationary beekeeping depends much more on the presence of trees, woodlands and wild forests for its nectar and pollen resources. This honey collected from the forest areas by bees of stationary beekeepers is valued most by the Vietnamese consumers, who believe it has special medicinal properties. Prices are up to 10 times higher than for the equivalent honey of *A. mellifera*, and up to 5 times higher than for honey of the same bee from professional migratory beekeepers.

The various stages of bee management practice that still exist in Vietnam are given below in evolutionary order. It will illustrate that at present traditional beekeeping is mainly present in forest areas.

1. Honey hunting from natural nests

Like anywhere else in Asia this basic practice of collecting honey, wax and beebrood is performed by specialized honey hunters. Their skills include: Tracing the nests by carefully observing foraging bees; climbing trees or rocks, opening nests, and calming the bees and finally collecting the combs, while avoiding as many stings as possible.

2. Honey gathering from natural nests at owned sites

Using a recognizable carved mark, a bee hunter indicates that he is the first person to have harvested from this nest site, either a cavity in a rock or a hollow tree (Figure 1, see cover). Depending on the accessibility of the site, the hunter will try not to destroy the colony while collecting the honeycombs. By doing so he may be able to successfully harvest several times from the same site. In some cases the hunter/owner has been able to return pieces of broodcomb that

Figure 2. A beekeeper in Tai Nguyen inspecting a colony in a fixed-comb hive. Note the zinc roofing; the ant preventing measures, and the bamboo queen cage.

have been cut away while collecting honey into the correct hanging position by using fork-split bamboo sticks as supports.

Once a colony has absconded, the abandoned site is cleaned by the owner, who removes any debris, thus prolonging his ownership over the site. To reaffirm ownership, a freshly carved mark may be added, or, in case of a hollow tree cavity, a stone may be put in it.

3. Moving natural colonies to an apiary

In this stage it is not the honey or the wax that is collected and brought home, but entire colonies for the purpose of further exploitation. When moving the nest, the bees and the combs with brood are separated, thus ensuring safe transport. Usually the queen is separated from the other bees, either by using some type of queen cage (e.g. made of bamboo; see Figure 2, see page 64) or by tethering the queen with a hair around her waist or binding her wings together. Once at home the colony (queen, broodcombs and bees) is transferred into a man-made hive. Sometimes such hived colonies are offered for sale. Toumanoff and Nanta (1933) mentioned that most of the colonies kept in the villages at that time came directly from the forest and that some were bought from swarm collectors.

Figure 5. Beekeeper with a top-bar box hive. Note the space beteen the level of the top bars and th hive cover (Bac Son).

4. Collecting swarms from the forest

In forest regions some of the villagers are specialized in catching swarms in bait hives. Just before the swarming season, bait hives are put in or near big trees. Such hives can be made from any kind of hollow trunks. During this season the owner regularly visits the hives, checking for the presence of a swarm. Once the hive is occupied the owner will immediately bring it home, where it is transferred into a permanent hive to be kept in the village.

In villages more remote from the forest, some villagers go out into the forest for some days in search of sites where scout bees can be found, usually near the trunks of big trees. When the scout bees are found, the villagers position their bait hives in easily accessible clear open sites near the trunk of a big tree. There they try to catch scout bees using a butterfly net. The captured scout bee is immediately put into the entrance hole of a bait hive and confined inside for about half an hour by closing the flight hole. It is quite common for a swarm to occupy the bait hive within a few hours of the release of a scout bee. This technique of scout bee confinement has even led to games among swarm collectors where bee preference is tested for one of the collector's bait hives.

All four of the above stages procede what is acknowledged as apiary beekeeping.

5. Beekeeping using fixed-comb hives

There are several types of fixed-comb hives used in Vietnam:

- Sections of hollow tree trunks of various sizes, placed horizontally. Some of the trunks have typical wooden discs to close the lateral sides; some trunks have flight entrance holes in the central part, while others have them to one side or in one of the lateral discs.
- upright wooden trunks with or without a removable coverlid. In most cases the trunk has a rectangular side door that can be opened for colony inspection or harvesting.
- rectangular box hives, usually made of wood, with a removable front or back for inspecting the colony. Sometimes both sides are removable.

- Basket hives, as shown by Toumanoff and Nanta (1933) or wall hives, which are purposely made cavities in the thick loam walls of traditional houses at higher altitudes; both of these hives are quite rare.
- Cracks in the hive walls as well as lid or door chinks are usually plastered with clay, mud or buffalo/cow dung, in order to keep the number of flight entrances limited.
- In some cases when the tree trunks are voluminous, the hives are divided into two chambers. During dearth periods the colony uses one chamber only, while during honeyflow periods the second chamber is also used for comb construction and honey storage, thus forming the so called 'honey chamber'.

The first stages of apiary beekeeping with these fixed comb hives resemble these described above. However the colonies described above are found at natural sites, whereas those listed below are kept in man-made hives purposely positioned in the villages near the owners houses.

5a: The beekeeper harvests brood, honey, and wax only once from each colony by 'slaughtering' it at harvest time. Afterwards he must put in a new colony himself or wait for a swarm to occupy the hive again.

5b: The beekeeper tries to obtain several honey harvests each season by removing only part of the honeycombs from the colony each time. By doing so he might be able to keep the same colony for a period longer than one year.

5c: The beekeeper is skilled in keeping the same colonies for a longer period in the same hives. He is able to restore the cut out parts of the broodcomb by using forked bamboo sticks as supports so that the bees can reattach the loosened parts of combs in the right position.

5d: The beekeeper is able to execute further management techniques in order to prevent colony loss e. g. , by preventing swarming, absconding, starvation, or any loss due to predators. He is also able to multiply the colonies. These techniques include:

- catching and caging the queen (Figure 2, see page 64) and clipping her wing(s);

Figure 6. A simple type extractor. Not hygienic enough for good quality honey.

Figure 3: Top-bar hive with bars of equal length, placed on two parallel fringes (Cat Ba).

- preventing wasps, ants and birds from entering the hive and/or attacking the bees;
- dividing a colony into two new nuclei;
- using adequate swarm-catching methods, including forcing swarms to settle when they start coming off. This can be done by throwing handfulls of sand, dust, or water into the whirling swarm or by swinging a piece of cloth on a long bamboo pole into the swarm. At the same time a site is usually provided on which the swarm might settle, e. g., a helmet hanging from a rope or a circular disc of porous wood at the end of a pole (Toumanoff, 1933).

6. Beekeeping with movable comb (top bar) hives.

It appears that in northern Vietnam, a management system with movable comb-hives has developed from the above mentioned traditional methods. It is unique in Vietnam for *A. cerana*. Until

Figure 4. top-bar hive with bars of varying lengths, each one placed in carved-out spacings. A comb is lifted from the hive (Bac Thai).

recently this technique was only known to have developed in Greece with *A. mellifera*, where it was first described by Sir George Wheler in 1682 (Crane, 1983; Ifantidis, 1983). The earliest reference found, mentioning the use of top-bar hives in Vietnam, dates back to 1902 (Fougères, 1902). However, traditional beekeeping practice in Vietnam can be traced back to the 8th century.

Beekeepers using top bar hives understand the principle that bees build parallel combs with a fixed distance between the comb centers. They let the bees build their nest and make sure that the bees attach every comb to a separate pre-fixed parallel top bar. Under such conditions each comb can be taken out of the hive separately, by removing the top bar under which the comb is constructed. The greatest advantage of this system is that a comb can be observed at any time, which provides the beekeeper with much useful information.

Top bar hives are usually upright trunk hives with a removable cover plate or planks, under which the top bars are positioned. These bars are always parallel, with each end placed on a carved-out rim or on separately carved out spacings which keep the top bar in the pre-fixed position. (Figure 3, see page 69). Toumanoff and Nanta (1933) have also described horizontal trunk hives with top bars, that in some way were attached crosswise onto the upper part of the inner space of the trunk. Such hives had only two lateral openings and no upper opening or cover.

In general three types of top bars are recognized. They are described below according to the amount of beekeeping skills required and at the same time the increasing possibilities offered.

6a: Top bars with varying lengths in the same hive. The lengths vary according to the position of the bar at the top of the round hive opening (Figure 4, see page 70). Such hives usually have 5-7 top bars. This enables the beekeeper to lift out the comb from each position, thus inspecting the whole colony. However, every comb has its own specific position in which it has to be returned. This prevents the beekeeper from rearranging the nest by changing the comb order in a desired way. Honeycombs, usually present at the top of each top-bar comb, can be cut out with one cut just below the top bar and another above the brood area. The lower part containing the brood can be reattached to the top bar by means of two straws pierced through the comb and bound together over the top bar.

6b: Top bars with equal lengths.
Seen from the top the inner hive must be rectangular in shape. This is usually seen in rather heavy upright trunk hives and in wooden box hives constructed from planks (Figure 5, see page 65). Toumanoff (1938) has provided a figure of such a trunk hive in which the top bar spacings can be clearly observed. Combs in such hives are interchangeable within the same hive, and even among other hives when a standard top-bar size is used. Honey harvest is conducted as described in 6a.

6c: Top bars not positioned directly below the hive cover, but somewhat lower (5-10 cm) on a rim so that there is a free space between the cover and the top bars. In trunk hives such a rim is purposely carved out, whereas in box hives the rim is simply made by railing bars onto the inner sideboards. Before the honeyflow season there is an inner cover right on top of the top bars, so that the bees cannot enter the upper space. Sometimes this is only done by putting small sticks in between the top bars, only possible when there is space ($\pm$ 5-10 mm) between the top bars. During the honeyflow season, however, this inner cover or sticks are removed by the beekeeper. The bees then use the upper space for building more combs in which they store honey. The beekeeper can easily check for the presence of honey in the hive without disturbing the colony by removing the outer cover and cutting away these combs from the top of the top bars.

The first techniques described above represent the available beekeeping technology using *A. cerana* up to the moment when framehive beekeeping was introduced into the region (around 1935). Until then no other major technology had been introduced and thus these stages must be qualified as 'traditional'. Frame-hive beekeeping therefore must be qualified here either as 'introduced', 'post-traditional', or even 'alien' technology. However, it must be very clear that (introduced) frame-hive beekeeping forms a splendid example of appropriate advanced technology in this Vietnamese case, because it is the logical next step in the development of beekeeping.

IV. Comparing traditional with frame-hive beekeeping

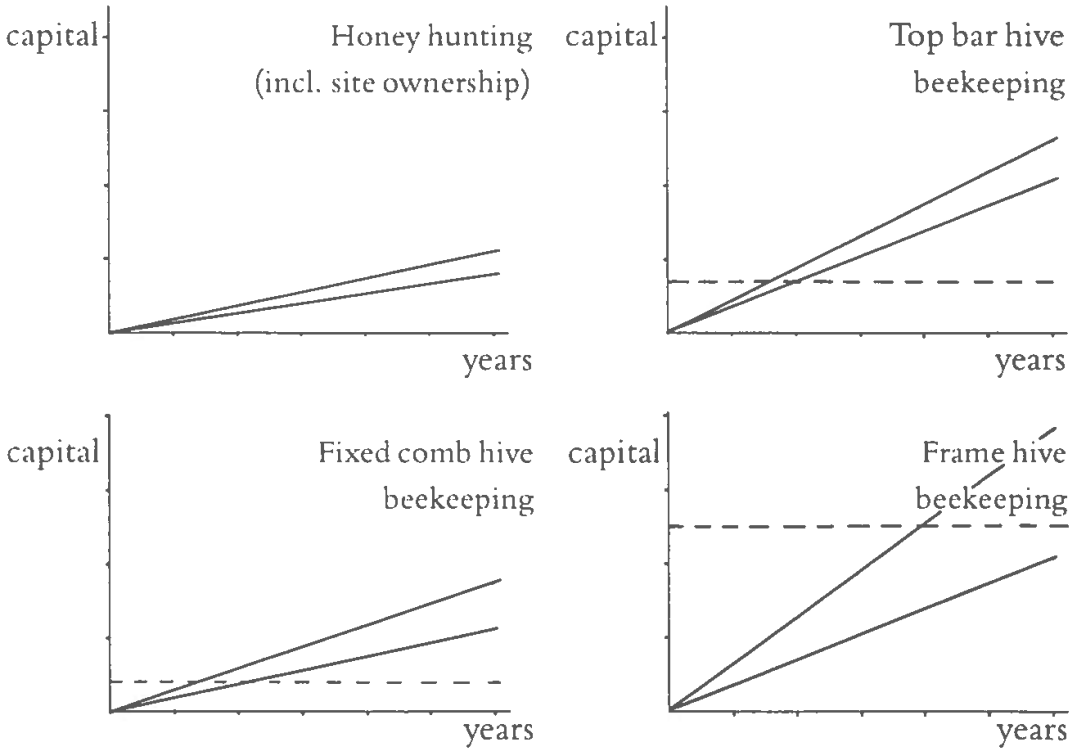
Since the 1960s framehive beekeeping with *A. cerana* has been mainly conducted by professional fulltime beekeepers, who migrate their apiaries up to 8 times a year. Furthermore a number of semi-professionals have adopted the use of frame hives and honey extractors on a smaller scale. With regard to this latter group there is in fact only one reason that can economically justify their choice for migration with frame hives: to increase the total honeyflow period.

For stationary (non-migratery) beekeepers the use of frame hives has some major disadvantages:

- Investment costs are very high; frames, thin wire, an extractor and foundation sheets are costly.
- Risks of frame hive beekeeping are higher and very often the higher technology level required, results in poor bee management, with colonies absconding in the end. Specific reasons for this might be incorrect use of comb foundation or, when this is not used, poor control over the correct parallel comb construction. Incorrect comb construction can be induced by a number of factors: incorrect spacing of the frames; the beekeeper fails to remove old comb which the bees do not cover, so that pests and diseases can attack more easily; full-size combs are used in frames in small colonies which leads to an energetically nonideal shape of the broodnest (it should resemble a natural globe) and finally, honey extraction methods for framed combs often harm the brood and spread diseases (Mulder and De Vries, 1990).

- The correct conditions under which frame hive beekeeping is advantageous are not met with, when for example the beekeeper is not (able to) migrating his colonies to different favourable honey resource areas, or he does not (know how to) use an extractor (Figure 6, see page 68). This is partly due to a bad choice in technology level: such a beekeeper might have chosen top-bar hive beekeeping, for instance, and perhaps would have done so, if he had had the right information.

Taking into consideration the input and output expectations for the various stages of honey production described above, we can conclude that frame-hive beekeeping bears the highest risks and top bar hive beekeeping the most prospects. Only with a thorough practical experience in frame-hive beekeeping, like the professionals in Vietnam have, does such beekeeping appear feasible. The graphs show input/output models for 4 different stages. Values of stationary, medium experienced (with less than 10 colonies) beekeepers are used.



_____ = yield output; accumulated
- - - - - = basic investment input (material)
(after Villières, 1987)

V. References

Crane, E., Luyen, V. V., Mulder, V. H. and Ta, T. C. (1991); A traditiona management system for *Apis dorsata* in *Melaleuca leucadendron* forest, Mekong delta, southern Vietnam. *Bee Wld*, in press

Crane, E. (1983) *The Archaeology of Beekeeping*. London: Duckworth

Fougères, Marquis de (1902) Rapport op de bijenteelt in de koloniën; Bestuur van Indochina. *Internationaal Congres 's-Hertogenbosch* 1902: 53-58 (also in French)

Ifantidis, M. D. (1983) The movable-nest hive: a possible forerunner to the movable-comb hive. *Bee Wld*, 64(2): 79-87

J. G. C. (1933) Notes sur les abeilles et l'apiculture en Indochine. (D'après Poilane) *Rev. Bot. Appl. Agric. Trop.* 13, 146/147: 808-811

Masse, M. (1948) L'Apiculture en Indochine. *Bull. Soc. Etud. Indochinoises* 23(2): 79-99

Mulder, V. and De Vries, R. (1990) Honey quality and management. A case study from Vietnam. *AT Source* 18(1): 18-22; [Or in French: Source de TA, 18(1): 18-22]

Toumanoff, C. (1933) Documentation sur l'apiculture annamite. *Bull. Econ. Indochine* 1933 Jan-Avr.: 169-180

Toumanoff, C. and Nanta, H. (1933) *Enquête sur l'apiculture au Tonkin. Bull. Econ. Indochine,* 1933 Nov-Dec.: 1015-1048

Toumanoff, C. (1938) Les enemies des abeilles; Les hymenoptères aux abeilles en Indochine et en France. Bull. Econ. Indochine, 41(5): 1104a

Villières, B. (1987) *Le point sur l'apiculture en Afrique tropicale*. Dossier No 11. Paris GRET; AFVP; ACCT: 105

The history of honey and wax production of the giant honeybee (*Apis dorsata*) in Sumatra and Kalimantan, Indonesia

Remy de Vries (revised by J. Beetsma)

1. Introduction

In the Malayan Archipelago honey is collected from three indigenous honeybee species: the dwarf honeybee (*Apis florea*), the giant honeybee (*A. dorsata*) and the Eastern honeybee (*A. cerana*). The Western honeybee (*A. mellifera*) has been imported. In addition several indigenous species of stingless bees (*Trigona* spp.) are found. The giant honeybee, with its very large nest, has always been the major honey- and wax-producing species in South-East Asia. This article deals with early references on honey and wax hunting with regard to this species on Sumatra and on beekeeping practices with the giant honeybee in Kalimantan, Borneo.

2. Distribution of Apis dorsata

The giant honeybee is found throughout almost the entire Indo-Malaysian region. According to Maa (1953) and Ruttner (1988) the sub species *A. dorsata binghami* is restricted to Sulawesi (formerly Celebes). The habitat of *A. dorsata* and the gathering of honey, wax and bee brood by hunters from its nests have been reported by many researchers, e. g., Alderley (1874), Mueller (1857), O'Forbes (1886) and Wallace (1906). O'Forbes (1886) was probably the first to describe, unknowingly, the migration or swarming of the giant honeybee.

3. The trees on which the nests were found

Generally the giant honeybee builds its nest in very high (30-50 m) trees, with almost horizontal branches, smooth trunks and without climbing plants and epiphytes. Lahjie and Seibert (1990) state that in East Kalimantan the absence of these plants reduces the chance of fungal infestation of bee nests. These bee-trees were always owned by individuals and were exempted from land leases (Van Hasselt, 1882) like fruit trees (Schneider, 1908). The following tree species have been mentioned by various authors:

Alstonia *angustifolia, A. calophylla, A. exima, A. grandiflora, A. pneumatophora, A. polyphylla, A. scholaris, A. spatulata, A. spectabilis,* ***Artocarpus*** *altissima, A. maingayi,* ***Blaberopus*** *spp.,* ***Bobea*** *wallichiana,* ***Canarium*** *spp.,* ***Cyrtosiphonia*** *madurensis,* ***Covelia*** *albipila,* ***Dipterocarpus*** *crinitus, D. hasseltii,* ***Erythrina*** *spp.,* ***Gluta*** *wallichii,* ***Gymnostoma*** *sumatranum,* ***Koompassia*** *excelsa, K. malaccensis,* ***Luffa*** *acutangula,* ***Maranthes*** *corymbosa,* ***Ophioxylon*** *serpentinum, O. trifoliatum,* ***Santiria*** *griffithii and* ***Shorea*** *bracteolata.*

The reported number of nests per bee-tree varies considerably: 30-40 (Van Hasselt, 1882); 50-100 and exceptionally 200 (Van Cattenburch, 1864); 130 (Goldsworthy, 1978) and 200 (Zwaan, 1934) for the Palembang region.

4. The honey harvest

The harvesting of combs was mostly performed by specialized harvesters, who were often accompanied by two or three helpers, one of them often the owner of the tree (Van Hasselt, 1882). The harvester was usually an old man with much knowledge of bees, assisted by a young apprentice. Frequently, a third man was employed to raise and lower the bucket when collecting the honey comb (Goldsworthy, 1978). The harvesters did not just have knowledge of bees. As noted by Goldsworthy (1978): „These harvesters were also 'shaman', only recognized honey shaman could cope with the spiritual and physical dangers of honey collecting: they were especially careful to avoid angering the spirit which was believed to inhabit bee-trees". By climbing trees and robbing nests the shaman could be accused of invading the spirit's territory. Its wrath can only

be avoided by taking the proper precautions. Because of his knowledge of the spirit world would the shaman protect other people. The spirits were believed to live in the large hollow projections of the bee-tree trunks (Skeat, 1900). This inhabitation also explains why, apart from their economical value, bee-trees were seldom felled (Goldsworthy, 1978; Van Hasselt, 1882; Neumann, 1906; Skeat, 1900). Other tasks of the shaman were to expel spirits from bee-trees when they did have to be felled (Skeat, 1900) or to expel swarms from houses.

Physical dangers that have been reported are falling from the tree and being stung. In addition, tigers, bears and wild boars were often found in the vicinity of bee-trees, attracted by the smell of wax and honey from fallen combs. Lighting fires for protection from these animals was impracticable, because fires would attract bees (Van Cattenburch, 1864; Van Hasselt, 1862).

5. The time of harvesting

Harvesting was often performed on dark moonless nights because the bees were said to be unable to see well in the dark (Van Cattenburch, 1864; Goldsworthy, 1978; Van Hasselt, 1882; Zwaan, 1934). Harvesting was done during the months December-February, which was the flowering season of the durian (Goldsworthy, 1978), or during the months January-March, the flowering season of paddy, and August, when maize was in bloom (Van Cattenburch, 1864).

6. Construction of a ladder

After reaching the bee-tree one of the helpers would start to peel rattan (to be used as rope), while the others gathered lianas or thin trees to construct a ladder alongside the tree. Bamboo pegs were driven into the tree trunk with a heavy hammer at intervals of about 0.5 m (Schneider, 1908). This was done two days before the actual harvesting took place. These pegs were interconnected by binding the gathered lianas or thin tree stems to the pegs with rattan, thus forming the rungs of a ladder.

There were rules on how to hammer the first pegs into the tree.

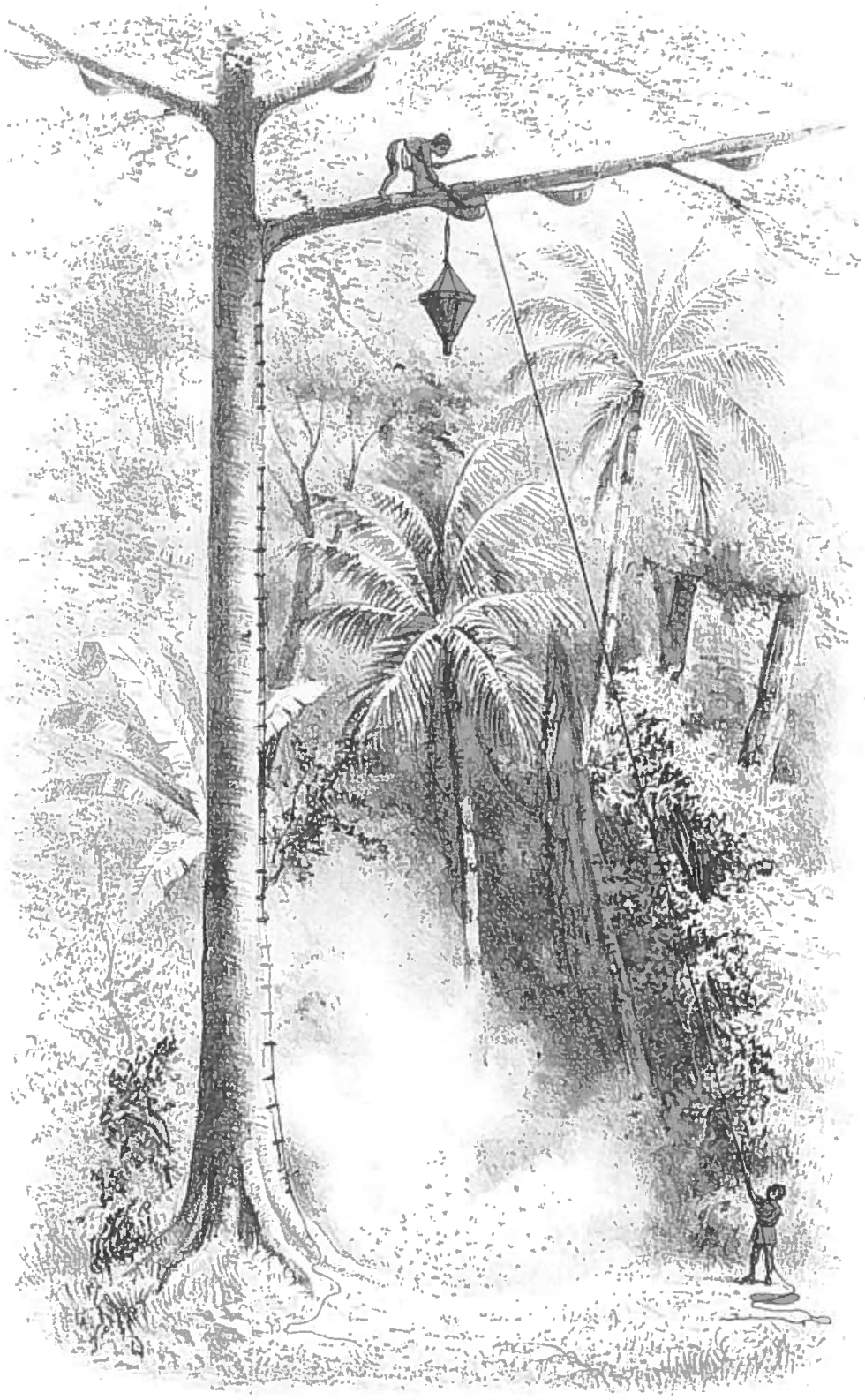


Figure 1. Drawing of a honey-harvest scene in Sumatra (in: Van Hasselt, 1882)

Van Hasselt (1882) mentioned that the first peg ('the old peg') had to be hammered into the tree with two heavy blows and one soft blow and the second peg ('the peg below the old peg') with six heavy blows and one soft one, while the rest of the pegs were not subjected to rules (Figure 1, see page 78). Goldsworthy (1978) reported that in Negri Sembilan (Peninsula Malaysia) all the pegs were struck once to hammer them into the tree, except for the lowest peg, which received three blows, in the hope that it would go right through the tree trunk and thus provide good support. Also the word 'peg' should not be mentioned during hammering; the word nail should be used instead, since a nail is inseparable from a finger and pegs should be inseparable from the bee-tree. Harvesting tools should never be made of iron, so that the spirits are not offended (Goldsworthy, 1978; Neumann, 1906). For the Karo Bataks the spirits not only forbade the use of iron, but also stipulated that the harvester's headcloth must be made of thin cane (Neumann, 1906).

7. Climbing the tree

After the ladder had been completed, a final counsel was held to determine whether the time was right for harvesting. When the decision to continue had been reached, the head harvester would light a torch made from the bark of *Sterculia foetida* (which gives low flames and many sparks), take a wooden knife and a rope connected to the basket and start to climb the ladder (see Figure 2, page 81). While climbing the harvester would sing a song at three separate positions on the ladder (see Van Hasselt, 1882; for more song texts, see also Dussek 1928):

- when standing on the lowest peg, the 'old song' was sung.
- when standing halfway up the ladder, the second song was sung
- when reaching the first branch, the third song was sung.

Goldsworthy (1978) mentioned:

„The shaman sang songs hoping to lull the bees into a false sense of security by the beauty, of the songs and the placatory words. He sang to entertain, flatter and cajole in the hope of distracting them from his purpose, as well as to intensify his own concentration on the harvesting job".

8. Harvesting honey and wax

According to Van Hasselt (1882) the harvester walked along the branch singing another song, this time to persuade the bees to fly down with the sparks of the torch. Arriving at the first nest, he would wave the torch beside the nest and start to beat the branch above the nest with the torch. The bees would drop down with the sparks. The song and the beating continued until all the bees had left the nest. When this had occurred, the harvester would stab/cut the combs loose with the wooden trowel-shaped knife. In Malay the word for 'stabbing' is **camuk**, the name is also used for professional honey hunters, while **tualang** is the name used for honey gatherers (Mardan et al., 1989). Singing continuously, the harvester continued until all the nests were stabbed. However, if he reached a comb containing honey his song would change and he would signal his aides to hoist up the basket so that he could put it right under the comb before cutting (see Figure 2, page 81).

Goldsworthy (1978) reported that first the lower part of the comb was cut (containing brood) and allowed to drop. After the aides had hoisted up the basket to collect the honey, the remaining part was cut.

After having cut all the combs, the head harvester would then sing a farewell song and descend. While standing on the lowest peg he would sing the last song, recommending the care of the bee-tree to the forest spirits. Then the combs on the ground were collected and carried home. When the honeycombs were lowered in the basket, the honey would be pressed by hand by the aides and poured into bamboo containers. Sometimes the combs would be collected the next day. The honey, being without economic value, was then divided equally among the participants. The wax combs were melted, purified and moulded into balls or cylinders and divided. If the owner accompanied them, he received 1/3 of the wax; if he did not, he received 1/6. The harvester received 1/3, and the rest was equally divided among the aides.

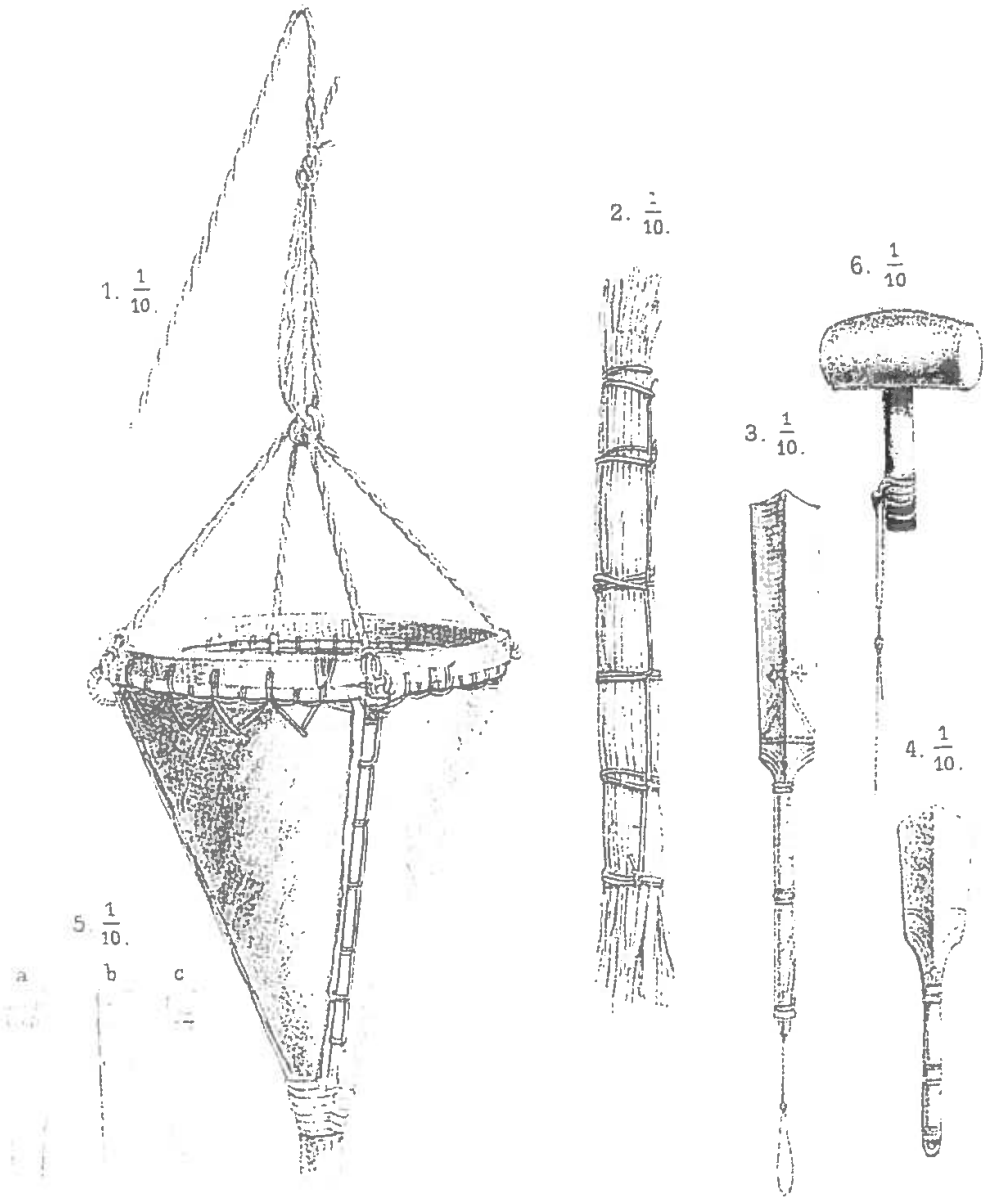


Figure 2. Tools used for honey harvesting in Sumatra (Van Hasselt, 1882)

1. basket of woven rattan, hoisting rope for basket;
2. torch made from Sterculia foetida bark;
3. and 4. wooden trowel- shaped knife;
5. sharpened bamboo pegs (about 0. 35 m long)
a. the old peg, (the first step)
b. the peg below the old peg (the second step)
c. one of the following pegs;
6. heavy wooden hammer.

9. Management practices

Apart from harvesting combs, in some areas special measures were taken to ensure conservation of the bee-trees and their colonies in order to improve nesting and thus harvesting possibilities. Harvesting was done in a defined manner to ensure the survival of the colony and certain rules had to be followed:

- harvesting was done by specialists;
- hereditary ownership was regulated and acknowledged;
- additional work was executed to make the surroundings of bee-trees more accessible;
- trees were prepared to form suitable nesting sites; and
- attacks from bee enemies were prevented.

In some parts of Sumatra only honey was harvested, the part of the comb containing honey being cut, leaving the brood comb attached to the tree (Von Hadorn, 1948: see Figure 3, page 83).

Hereditary ownership of bee-trees could be obtained by the following two-fold procedure (Van Cattenburch, 1864):

1. water in which a diamond had been soaked for 24 hrs had to be poured, from the crown downwards, and
2. the bones of a man, who had died a violent death by spear or kris, had to be buried under the bee-tree.

Trunks and branches of bee-trees were cleared of climbing plants and epiphytes and smoothened by grinding and sanding to make the trees attractive nesting sites to the bees. For the same reason the undergrowth was cleared (Van Cattenburch, 1864; Schwaner, 1853; Zwaan, 1934).

In the Lampung districts (southern Sumatra) scaffolds were constructed under the bee-tree, to protect aides against tigers, bears and wild boars that were attracted by the smell of the wax (Van Cattenburch, 1864). Paths to high-yielding trees and small houses to provide shelter near bee-trees were also built (Zwaan, 1934).

Thorny wreaths were often placed around the trunks (Van Cattenburch, 1864) to protect the nests against attacks from the Malayan honey/sun bear, *Helarctos malayanus*, that was known to climb trees and rob nests (Van Cattenburch, 1864; Hose, 1929;

Figure 3. Honey harvest procedure leaving the brood attached to the tree

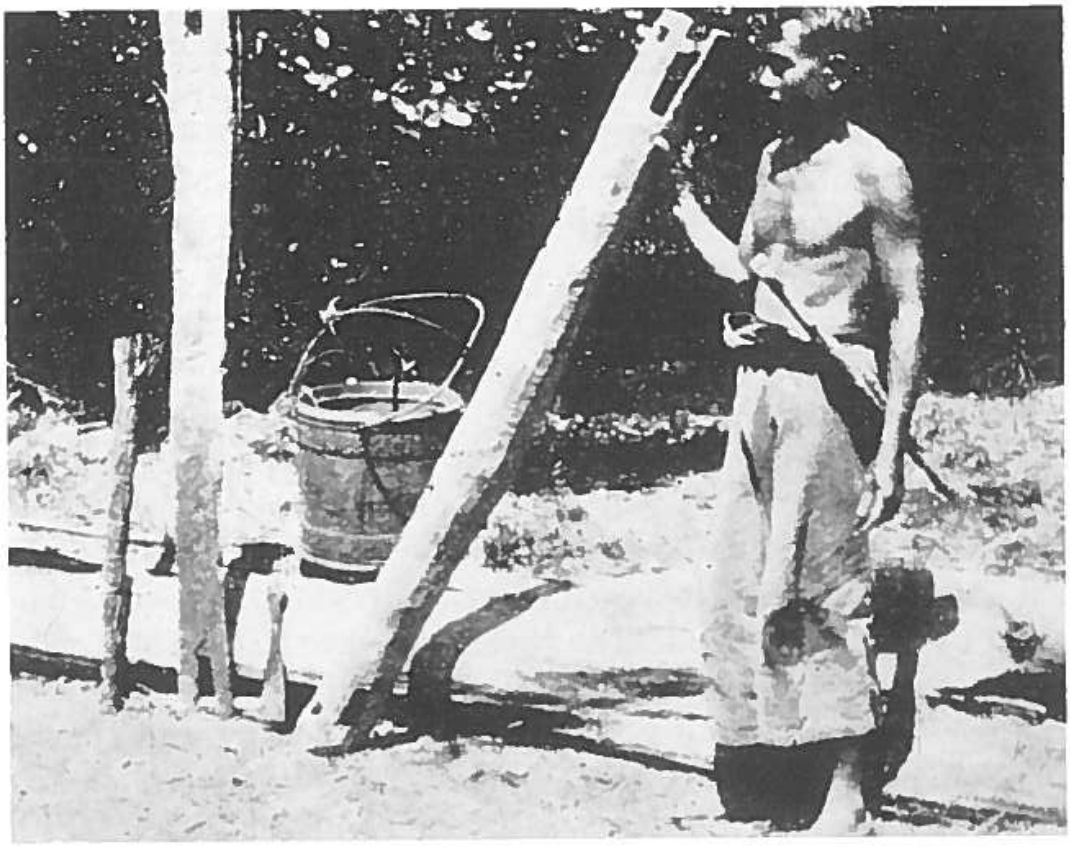


Figure 4. A beekeeper showing tikung poles and honey harvest equipment.

Jacobson, 1927). Attacking birds (according to Van der Meer Mohr (1940): *Pernis apivorus ptilorhynchus*, which Harrison and Tweedie (1965) called the 'Honey-buzzard') were chased away by firing rifles or throwing stones in the air. These birds would fly into the combs and break them from the branch, so that they could eat the brood (Van Cattenburch, 1864).

10 Beekeeping practices with the giant honeybee

In the lake district of western Borneo (Kalimantan), an advanced system of management and harvesting has been described (De Mol, 1933; see also Crane et al., to be published): Previously, the entire lake district consisted of an area of high trees and bush-like vegetation, with shallow places flooding during the rainy season. After the annual two-month drought period there was an abundance of flowers which attracted migrating *Apis dorsata* colonies from the hills and mountains. At the beginning of each rainy season the swarms would return to the hills.

Some 500 families of fishermen were living in the lake district in 1933, collecting honey and wax alongside their fishing activities. These people used to place length-wise split poles ('tikungs') in the crowns of trees, at an angle to facilitate water run-off. With the round side of the pole downward, these poles were attached at both ends to tree branches in a shady place. Once put in the right position they were never removed. **Kaju tembesu** wood (*Fagraea fragrans*) was often used for these poles. The length of the poles varied between 1.6 and 2.25 m, with an incision at each end, so that the tree branches could be fastened with a pin through a lateral hole. The number of poles owned per family ranged from 40 to 150, but some families owned 1.000-2.000 'tikungs'. All poles were marked with a personal mark to claim ownership.

Apis dorsata colonies migrating to the lake area built combs hanging down from these poles. After the bees migrated, the combs were cut off and pressed. The honey was then stored in earthen vessels and the wax was boiled, pressed and strained. One member of the community acted as **kepala tikung**. He had to know all the different owner-marks as well as the places where people had their poles. He also acted as mediator in cases of conflicts. This unofficial

position was hereditary and its authority based on the cooperative agreement of the entire population.

11. References

Alderley, Lord Stanley of (1874) *The first voyage round the world by Magellan, translated from the accounts of Pigafetta*. Hakluyt Society. Reprinted by Burt Franklin, New York.

Cattenburch, F. M. G. van (1864) De bijenteelt in de Lampongsche districten. *Kennis der bijenteelt in Nederlandsch Indië, Tijdschr. Nijverheid en Landbouw Ned. Indië*, 253-262.

Goldsworthy, D. (1978) Honey-collecting ceremonies on the East Coast on North Sumatra, 1-44. In: Kartoni, M. J. (ed.) *Studies in Indonesian music*. Monash Papers on Southeast Asia. No. 7. Australia.

Hadorn, H. Von (1948) Betrachtungen ueber wilde Bienen in Sumatra. *Schweiz. Bienenztg.*, 309-314.

Harrison, J. L. and Tweedie, M. W. F. (1965) *Malayan Animal Life*. Longmans, Kuala Lumpur, Malaysia.

Hasselt, A. L. van (1882) Volksbeschrijving van Midden-Sumatra. Veth. P. J. (ed.) *Midden-Sumatra, Reizen en onderzoekingen der Sumatra-expeditie 1877-1879* (10 vol.) vol. 1: 1 (1) 420/ vol. 1: 1 (2) 240/ vol. 3: 1 (1) 307/311/ vol 3: 1 (2) 168-170 and Ethnografische Atlas: Figures LXXXVII and LXXXVIII, 37-38, E. J. Brill, Leiden.

Hose, C. (1929) *The Field Book of a Jungle Wallah. London.*

Jacobson, E. (1927) Houtbewerking door beren. *Trop. Natuur* (16) 120-121.

Lahjie, Abubakar M. and Seibert, B. (1990) Honey gathering by people in the interior of East Kalimantan. *Bee Wld* (71) 4, 153-157

Maa, T. C. (1953) An inquiry into systematics of the Tribus Apini or Honeybees (Hymenoptera). *Treubia* (21) 525-640

Mardan, M., Hamid, A. H., Emby, Z., Marasidi, A. R. and Ismail, M. M. (1989) Some aspects of honey collecting from colonies of *Apis dorsata* in Peninsular Malaysia. *Proc. 4th Int. Conf. Apic. Trop. Clim.*, Cairo, Egypt. IBRA, Cardiff. UK.

Meer Mohr, J. C. van der (1940) Doodelijke bijensteken. *Trop. Natuur* (29) 170.

Mol, G. A. de (1933) Inzameling van was en honing in het merengebied van de westerafdeling van Borneo (with english summary). *Landbouw* (9) 2, 80-86.

Mueller, S. (1857) *Reizen en onderzoekingen in den Indischen Archipel (1826-1836)* (2 vol.) F. Muller, Amsterdam.

Neumann, J. H. (1906) Een en ander aangaande de Karo-Bataks (vervolg). De honinghaler. *Meded. Ned. Zending Genootschap* (50) 30-40.

O'Forbes, H. (1886) *Wanderungen eines Naturforschers in Mal. Arch.* (1878-1883). Jena.

Ruttner, F. (1988) *Biography and Taxonomy of Honeybees.* Springer Verlag, Berlin, Germany, 284 pp.

Schneider, G. (1908) Ueber eine Urwald Biene (*Apis dorsata F.*). *Z. wiss. Insektenbiol.* (4), 447-453.

Schwaner, C. A. L. M. (1853) *Borneo, beschrijving van het stroomgebied van den Barito.* Amsterdam.

Skeat, W. W. (1900) *Malay Magic.* MacMillan and Co. Ltd, London, (Reprint 1967) 2 vol. , Dover Publications Inc. , New York.

Wallace, A. R. (1906) *Insulinde.* (Translation of: *The Malay Archipelago* (1896) London.) Amsterdam.

Zwaan, C. J. (1934) Wilde bijennesten. *Het Bosch* (II) 4, 124-127.

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