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TROPICAL APICULTURE AND THE NEED FOR A GLOBAL STRATEGY

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1. The different tropical/subtropical regions.
2. The roles of tradition and modern technology.
3. Subtropical regions
4. The need for a global strategy.

In this short survey of tropical apiculture and the need for a global strategy, I shall speak first about apiculture in the tropics and subtropics in general, then about some problems of the full tropics and the respective roles of traditional and modern technology in apiculture there. I shall comment on the great success of beekeeping in the subtropics and the reasons for it, and finally explain briefly why a global strategy is needed that takes account of all the world's regions - tropics, subtropics and temperate zones.

1. The different tropical/subtropical regions

Three continents - Africa, Asia and America - all have large tropical amd subtropical regions. The Pacific islands form a large fourth tropical/subtropical region. Each of these regions has its own distinct characteristics with regard to honey-producing bees, to food resources for the bees, and to enemies, parasites and pathogens that can injure the bees and their nests.

Most of the apiculture to be discussed at this Conference is based on the honeybee Apis mellifera. Africa is the only region with native tropical subspecies of this bee. On the other hand Asia has three native tropical species of honeybees, Apis cerana, Apis dorsata and Apis florea, which do not exist elsewhere. Apis cerana is like a rather smaller version of A. mellifera, and papers from India especially will describe beekeeping with this bee. The other two species of honeybee cannot be kept in hives, because their nest is a single comb in the open air. Nevertheless a form of beekeeping has been developed with Apis florea in Oman.

The Americas and the Caribbean islands have no native honeybees (Apis species). Hives of Apis mellifera from Europe were taken to North America in the early 1600s, and to Central and South America in th e 1800s, and beekeeping there was based on these bees. However, in 1956 tropical African honeybees were taken to Brazil, and they are now the basis of beekeeping - and of many difficulties and much discussion - in tropical America. Their future influence on beekeeping in North America has caused much heart-searching there.

Finally there are the Pacific islands, too recent geologically to have any native honeybees. European Apis mellifera have been taken to most groups of Pacific islands in the past hundred years or so, but the remainder are still without honeybees. There are strong ecological reasons why they should never be taken to certain islands, because of the need to conserve native species of pollinators and of the plants they pollinate.

At various times European Apis mellifera bees have been introduced by man into all four of the tropical regions. They often thrived in sub-tropical climates, or where there were no native Apis species (as on Pacific islands), but not always where these are present. I shall mention the introduction of tropical Apis mellifera from Africa to America again, later on.

The whole tropical zone of the earth is rich in flowering plants - much more so than the cooler temperate regions to the north and south. Each of the tropical regions has certain characteristics of its own. Across almost the whole of tropical Africa is a belt of miombo, open woodland rich in honey sources, notably Brachystegia and Julbernardia. Tropical Asia has a wealth of bee forage; these plants have been especially well studied in India, and many are listed in a "Code for conservation and maintenance of honeybees" published by the Indian Standards Institution. Pacific islands, along with coastal regions elsewhere, have coconut and other plants suited to the maritime tropics. In South America are the world's greatest remaining tropical forests, and there are productive honey-yielding areas to the north and south of them; Mexico and Argentina (after China) are the world's major honey-exporting countries.

Then there are the agricultural and horticultural crops. Profitable crop plants have been introduced widely from one continent to another. So, for instance, bananas and coffee are grown in all four tropical regions. In June this year the International Bee Research Association published a "Directory of important world honey sources", funded by the International Development Research Centre in Canada. The book covers the tropics, subtropics and temperate zones. Before the end of 1984 we shall also publish a "Pollination directory for world crops", under funding from the New Zealand Ministry of Foreign Affairs. We found that over a quarter of the world's crop species are also important honey sources. And almost all these crops - and a good many others - give better yields, and a higher financial return, if sufficient honeybees are present to pollinate them. This benefit of beekeeping to agriculture cannot be too highly stressed.

The use of bees for pollination is one of the important subjects for discussion during the Conference.

Just as there is less appreciation in the tropics of the value of bees as pollinators, so there is far less appreciation of the damage that can be caused by the killing of bees through pest control measures. Last year the Tropical Development Research Institute in London funded a study on "The impact of pest management on bees and pollination", which highlights the terrible situation with some crops, and also offers a number of recommendations for improving it.

2. The roles of tradition and of modern technology

We must now return from pollination to apiculture proper, that is the keeping of bees in hives from which the beekeeper can harvest their products.

Of the four tropical regions, Africa has the oldest tradition of beekeeping, and the one that survives most vigorously, in the main still with primitive hives. The earliest evidence of beekeeping is also to be found in Africa; four representations of harvesting honey from hives remain from Ancient Egypt, dating from 2500 to 650 BC. A number of countries in tropical Africa have a rich tradition of beekeeping, with hives that use

local materials and are adapted for their purpose. Many of us here knew and loved Jim Nightingale of Njoro in Kenya, who died last year. His whole life was spent in this country, and everywhere he went he got to know the beekeepers and learned their ways. His recollections of Kenya tribal beekeeping were published last year as a memorial to him. It has been suggested that this Conference would provide a special occasion for remembering Jim Nightingale and his beekeeping.

Traditional beekeeping - as well as honey hunting - is carried out with equipment made from local materials at virtually no cost, and following the experience of previous generations. Most beekeeping development programmes - especially those that are bilateral or funded by an international source - are based on improved management techniques using purchased or locally manufactured equipment. They can give higher yields, but it is important to understand that replacement of an activity based on the use of renewable environmental resources, by one based on high-cost purchases (whether from domestic or foreign suppliers) changes the nature of the enterprise. The effects of this change may be good or bad. The aim of large-scale honey production leading to export on to the world market is very different from the concept of apiculture as providing additional food for subsistence level farmer.

Historically, modern movable-frame hives were devised by peoples whose bee management was derived from tree-beekeeping in the forests of northern Europe. The tending of colonies of bees in hollow tree trunks in the forests led to upright log hives, and to basket hives used mouth downwards. Progress was subsequently achieved by extending hives vertically, not horizontally as with some hives used farther south: in Morocoo, Malta, Greece and Kashmir for example.

One can argue - and I myself have done so in my book "The archaeology of beekeeping" - that there could also be a biological factor. In climates with a cold winter, colonies of bees can more easily maintain a temperature high enough for survival in an upright hive with a thermal buffer of honey stores above the brood nest. On the other hand in hot climates, colonies can perhaps more easily keep their nest from overheating in a long horizontal hive where they can achieve cooling by spreading out along the length of the hive.

As far as the beekeeper is concerned, in cooler regions honey can be left on the hive throughout the warm active season and harvested once a year, before the cold winter sets in. In the tropics honey is produced over a longer season, and the bees do not need such a large honey store. Various hazards may make it advisable for the beekeeper not to leave honey in the hive for too long a period, but to take a few honey combs at a time. He often follows the method used in Ancient Egypt, and takes the honey from one end of the hive; he leaves combs at the other end intact.

The modern frame hive differs from horizontal traditional hives used in most of the world, in several important ways.

1. It consists of a number of boxes that are stacked one above the other. Bees thus expand their nest upwards, not sideways.
2. The capacity of the hive is readily increased in accordance with growth of the bee population or of honey stores, by adding further boxes (supers) at the top of the hive.

3. Separate hives boxes can be interchanged when this is useful for hive management.
4. Bees build their combs in rectangular frames with which the hive boxes are fitted (like files in a suspension filing system). These frames are so arranged that they leave a space or gap between the frame and the hive wall. The space is precisely determined, so that bees do not build comb across it. The frame hangs free, and the beekeeper can lift out each frame with its comb - hence the term movable-frame hive. This facility to lift out and inspect frames, and to replace them in a different position, allows great flexibility in hive management, leading to increased honey yields.
5. The beekeeper is able to remove all the bees from a hive box when it is full of honey, by using a blower to blow them out, by repelling them with smoke, or a chemical, or by a mechanical contrivance known as a bee escape. He can then take off the boxes of honey empty of bees, and without harming the bees in any way.

The facilities in bee and colony management brought about by the modern frame hive have made the world's present beekeeping industry possible. They have led to the great growth of honey production on a commercial basis in temperate and subtropical regions. In parts of the full tropics, however, advantages of standard movable-frame hives are not so complete. Tropical hive bees - Apis cerana in Asia, and tropical Apis mellifera in Africa and now in tropical America - are not as amenable as temperate-zone bees to interference with their nest. Colony management by the beekeeper - which is facilitated by the frame hive, can have unfortunate results with tropical African bees. When a modern hive is opened by removing the roof, the bees may well fly off the combs en masse to defend their nest, and attack their intruder - the beekeeper. If the top box of the hive is removed to inspect a lower one, another area of bees is exposed, and so on. The beekeeper's disturbance of the hive may even cause the whole colony to absconde from the hive and fly off to another site.

A further disadvantage of modern hives over traditional ones is that they are expensive in materials (suitable well seasoned wood, or else plastic) and in manufacture (because much precision is involved). Also they may have to be imported and paid for in hard currency. Traditional hives are made locally, and have none of these disadvantages.

One compromise, at the intermediate technology level, is a top-bar hive, consisting of a single long box with inward-sloping sides. Top-bars are laid across the open top of the hive, at the required spacing; this is the only precision measurement necessary in the hive. Bees build their combs down from the top-bars, but do not attach them to the hive sides because of their inward slope. Such hives are movable-comb hives. In one type developed especially here in Kenya, the top-bars are wide enough so that there is no gap between them; when a beekeeper works on a hive, the only area where bees are exposed is the gap from which a single top-bar (with its comb) has been removed. The hive cannot of course be extended upwards, and it is made extra long for honey storage at one or both ends. But the principle of a movable-comb top-bar hive is a basic one. Other variants are in use elsewhere, and still others will I hope be devised, made of inexpensive local materials.

To me, the question "Where are we now going with hives?" is a very important one, especially - although not only - in the tropics. I think that advances in the immediate future should be on a very broad front. In the middle there must be unexciting but necessary movements towards stand-

ards, possibly world standards, for hives in current commercial use. At one end of the advancing front are low-cost hives - some traditional, some devised specifically for their cheapness, and some in view of the needs of tropical rather than temperate-zone beekeepers and their bees. At the other end of the advancing front are high-rise and hyper-hives, operated in some temperate-zone countries with maximum mechanization, because labour costs are so high that it is the most effective way of working. I believe that useful developments may be achieved anywhere along the line: we must be ready to re-question the necessity for every hive fitting and part (especially where the cost of precision is incurred), and for every manipulation we make in dealing with bees and their honey. Above all we must be continually open to new ideas, wherever they come from, whether inside or outside the beekeeping fraternity.

3. Subtropical regions

This is the opening session of the Third International Conference on Apiculture in Tropical Climates. When we were planning the 1st Conference in 1976 - and this was a very exciting time for me personally - we knew that the subtropics should be included along with the tropics, although it would have made the title unwieldy to say this. The same policy has been continued, and a number of papers presented here will refer to the subtropics rather than the full tropics. The venue for the 2nd and 3rd Conferences has been in fully tropical countries - India and Kenya - and it might be worth considering a subtropical venue for the 4th Conference in 1988.

There is a great apicultural difference between the subtropics and the tropics. Southern types of European Apis mellifera introduced to many subtropical regions can adapt well, provided the beekeeper understands how to prevent the bees and their hives getting too hot. He places hives where there is some shade, even if only from a palm or cactus. If there is no shade, he provides it with thatch or corrugated cardboard or whatever can be contrived. Bees need a lot of water in order to cool their hives, and the beekeeper knows that he must either place hives within the bees' reach of permanent water, or provide that water himself; in Australia it may be taken to apiaries by truck over very long distances.

Large honey yields can be achieved in the subtropics, due mainly to two circumstances. First, some plant honey sources are in flower for most of the year, and the warmth allows the bees to fly out and forage on them. Secondly, modern frame hives can be used with bees of European origin, and the facilities this gives for colony management, and for queen rearing and so on, can be used to the full. Achievements since the 1950s in honey production and export by countries with subtropical regions show what can be done. China, Mexico and Argenina are good examples. China's rise, within 25 years, from having no honey exports to becoming the world's leading exporter, is indeed remarkable. I have not yet been able to visit China, but as I understand it, the native Apis cerana bees still flourish and give their more modest yields in the hill regions with much native vegetation, and introduced European Apis mellifera form the basis of the commercial honey industry in the plains and the agricultural areas - where many of the crops contribute to the honey yield. This is certainly true in Japan.

In subtropical America the situation is now complicated by the introduction of tropical African bees. They have already spread into the southern subtropics, and their spread into Mexico and other parts of the northern subtropics is predicted. They have so far reached Costa Rica. During the

Conference you will be hearing much about the problems - and also the possibilities of increased honey production - with these bees.

In many parts of tropical Asia the tradition has been honey hunting rather than beekeeping. For this reason there are fewer traditional hives, and modern hives are the norm in the present expansion phase of beekeeping. The most productive bee of tropical Asia, the large Apis dorsata, nests in the open. In many regions harvesting honey from Apis dorsata is more important than honey production with the Asiatic hive bee, Apis cerana. In most areas Apis cerana yields less honey per colony than Apis dorsata or Apis mellifera; nevertheless it has valuable characteristics in exploiting its native flora, and thrives where Apis mellifera cannot.

Introduced European Apis mellifera have proved successful in certain parts of tropical Asia which grow non-native crops whose flowering is out of phase with the local seasonal growth cycle of native honeybee colonies (Apis cerana). One success story has been the use of introduced European bees in the longan plantations of Chiang Mai in northern Thailand. But serious problems can arise if foreign bees are imported, and this should never be attempted without obtaining expert advice from bee scientists, and consulting quarantine officers. For instance introductions of foreign bees may bring new pests or diseases, which can then spread to the native bees and destroy them. The many other problems are too complex to discuss here. But I must emphasize the dangers of importing bees from another part of the world.

4. The need for a global strategy

In what I have said, I hope I have succeeded in showing the complexity of the apicultural situation, without making you too confused. In summary, we are conerned here with the tropics and the subtropics, with three land masses and the Pacific islands, with a variety of honey-producing bees, and with peoples at many different standards of living, of income, education and mechanization. Beekeepers use a wide variety of hives, and other types will doubtless be devised. All hives are for the beekeeper's benefit in obtaining his harvest from the bees. Success for the bees themselves is something different: to reproduce their kind by swarming. But they are astonishingly tolerant, and will live in many kinds of hive that are to the beekeeper's advantage.

Amid all the diversities of climate, bee forage, bees, hives, beekeepers and management techniques, there are in fact many common threads. Certain regions in different continents have similar climates, and to some extent similar bee forage. Eucalypts, coconut, citrus, bananas, brassicas, and forage legume, are examples of important honey sources in a great many parts of the tropics and subtropics. European honeybees are widespread, tropical African bees are now kept in much of South America, and Apis cerana is used in a large part of Asia. A great deal of existing information needs to be co-ordinated, in order to achieve the maximum benefit to apiculture.

Bees can be injured by a variety of diseases and parasites, and indeed beekeepers have been responsible for spreading many of these around the world by moving bees from one area to another. The world situation here is constantly changing except that, sadly, infection spread into an area is rarely cleared from it.

The multitude of problems - and of positive possibilities - that face beekeepers warrant a global strategy, in which, above all, knowledge and information are co-ordinated and made available for the benefit of beekeepers throughout the world. The need for such a global strategy is paramount in the tropics where the dangers - and the potential - are less well understood. Many of the feasibility studies on apiculture in different countries are undertaken as ad hoc exercises, whereas much of benefit could be learned by studying what has already been done. Also, at the end of a bilateral or international development programme, what happens when beekeepers in the country concerned are left on their own? What benefit survives after 5 years? after 10 years? How can future programmes learn from successes or failures of earlier ones? The German Aid Agency GTZ published a directory and guide to these programmes in 1982, and this information needs to be kept up to date and constantly reassessed.

At the International Bee Research Association we have been doing what we could towards co-ordinating and monitoring some of the ever-changing problems. We also provide much effective liaison world-wide. A number of innovative publications have been produced, with support from funding agencies. But funding had to be sought separately for every piece of work, and core funding for continuing work, however vital, is the most difficult of all to obtain.

We have however built up a solid basis of available knowledge on apiculture in the tropics and subtropics, on which a global strategy can be based. The Director, Dr. Margaret Adey, will read a paper about this later in the Conference. Further speakers will suggest ways in which such a global strategy can be implemented. Dr. Swaminathan, the other Vice-President of the Conference, is unfortunately not able to be with us today. But I know that I have his support in stressing the need for such a strategy, to identify and reduce the constraints that limit the effectiveness of tropical apiculture today. It would make a modest but real improvement in the lot of a great many subsistence farmers, and also in the gross national product of tropical lands.