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# THE SCOPE OF TROPICAL APICULTURE

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During the past two years we have been involved at IBRA in the preparation of the *Bibliography of tropical apiculture*\*. Although some of the work was often tedious for all concerned, the resulting publication proved to be exciting and rewarding, and is likely to influence beekeeping in developing countries for many years to come. This article, taken from the introductions to the various Parts of the *Bibliography*, provides a brief survey of apiculture in the tropics and subtropics. Like the *Bibliography* itself, it deals systematically with the separate regions, then with the honey-producing bees, their management and the equipment used for it, their products, the plant energy resources from which these are ultimately derived, and the role bees play in pollinating the plants. Finally, the tropical regions as a whole are set in perspective.

## Apiculture in the different regions

Parts 1-7 of the *Bibliography* list publications on the developing countries of the world region by region, 145 countries in all; if no publications could be discovered, a recent letter has sometimes been quoted. A further 39 countries are marked 'no information'; readers with any knowledge about one of these (even that there is no beekeeping) have been asked to send this information to IBRA. Where possible, additional information is included for each country on:

(a) beekeeping journals, which are a likely source of help in many ways. Addresses are given if known, and an indication of the holding in the IBRA Library.

(b) details of institutions receiving some or all of the *Bibliography*. Together with late entries in Part 24, names and addresses of 276 institutions are included, under their respective countries. These provide valuable points of contact, where there is already an interest in beekeeping, in 94 developing countries.

### 1. North Africa and the Middle East (179 publications)

This region includes subtropical regions that have several important characteristics. Firstly, much of the area is desert, and some of the rest is very dry; beekeeping is therefore restricted to irrigated areas and those with sufficient rainfall to support flowering plants; on the other hand desert oases provide unique opportunities to set up isolated mating stations for bee breeding. Secondly, the indigenous honeybees are more closely related to European bees than are those of any other tropical or sub-

\* *Bibliography of tropical apiculture* by Eva Crane, 380 pages, published by International Bee Research Association, price £30 or \$68; £24 or \$54 to IBRA Members, appropriate voluntary workers, individuals in developing countries, and full-time students. Institutions in developing countries can obtain from IBRA an application form for free copies of the separate Parts they require. Separate Parts can also be purchased from IBRA: those with up to 150 items £3 or \$7, those with more than 150 items £5 or \$11.50 (reduced rates are £2 or \$4.50, £3.50 or \$8). The preparation of the *Bibliography*, and its publication and distribution to developing countries, were funded by grant-aid from the International Development Research Centre, Ottawa, Canada, whose support enabled the enterprise to be undertaken and completed.

tropical region. Methods of management successful in Europe, and in North America where bees of European origin are also used, are more applicable to them than to honeybees indigenous in any other developing countries. Thirdly, the area must surely contain the cradle of the craft of beekeeping; pictorial records in Egypt exist from 2400 BC onwards. Egyptian universities are now centres for the study of apiculture, and *Satellite Bibliography S/25*, 'Beekeeping and bee research in Egypt', has 143 entries. European countries to the north lie outside the scope of the *Bibliography*, and so does Israel, which itself provides technical aid to a number of countries. There is beekeeping on Atlantic Islands, Madeira, the Canaries and the Azores, and on the Mediterranean islands of Malta, Crete, Rhodes and Cyprus, although not much has been published about it.

## 2. Africa south of the Sahara (354 publications)

This large area is probably the best documented of all the tropical regions except the Indian subcontinent, and the *Bibliography* lists publications from 49 different countries and islands, but in spite of the wealth of material represented here, it is probable that more knowledge has been irrevocably lost about beekeeping in Africa south of the Sahara than about any other region in the world. Surveys such as that by C. Seyffert's 'Biene und Honig in Volksleben der Afrikaner' (1930), and the memories of individuals who knew a part of the region well a generation ago, bear testimony to the richness of honey hunting and beekeeping traditions, and of the role of honey and beeswax in the cultural and economic life of various tribes. What now remains is put on record in Part 17, but it is only a fraction of what once existed.

*Satellite Bibliography S/26*, 'Beekeeping and bee research in eastern Africa', with 198 entries, covers a group of countries in eastern Africa (Kenya, Rhodesia, Tanzania, Zambia); *S/27*, 'Beekeeping and bee research in South Africa,' lists a further 177 publications.

## 3. The Indian sub-continent, with Afghanistan and Iran (171 publications)

There is enormous scope for interesting research work on the indigenous honeybees of countries in Asia to the north and west of India where *A. cerana* gives place to *A. mellifera*. There is probably also great scope for beekeeping development, but the first step is to find out more about the bees, the bee forage and the conditions for beekeeping in these regions. On the other hand India has published more information on beekeeping than all the rest of tropical Asia put together, and is the subject of *Satellite Bibliography S/28*, 'Beekeeping and bee research in India', with 376 references. India and neighbouring countries have three honeybee species, *Apis cerana*, *A. dorsata* and *A. florea*; *A. mellifera* has been introduced in a few areas.

## 4. Asia east of India (122 publications)

As far as beekeeping is concerned, this region must be the least well documented area of its size anywhere in the world. Even in large countries such as the Chinese People's Republic and Indonesia, relatively little has been published; size for size, the greatest amount of information has come from the Philippines.

On the other hand, in many countries of south-east Asia there is an intense desire to learn about beekeeping and to establish it as a rural industry. The region certainly has a great untapped beekeeping potential, and it is hoped that the information in publications cited here will help those concerned with setting up beekeeping enterprises to do

so effectively. Some areas may be faced with special difficulties and complexities in establishing beekeeping development programmes. Bees and colonies may be destroyed by enemies that are very difficult to control. Three species of *Apis* (*cerana*, *dorsata*, *florea*) are likely to be present, and pressure will probably come from one quarter or another to import the fourth species, *Apis mellifera*, if this has not already been done. It is essential that full enquiries should be made before the question of importation is decided: there are dangers of introducing pests and diseases with new bees, and also of irreversible damage to populations of the local, tropical honeybees.

## 5. Northern Latin America with Brazil (293 publications)

In Central and South America, all the honeybees used for beekeeping are introduced *Apis mellifera*, and all were of European stock until 1956, when *Apis mellifera* from Africa were imported into Brazil. The resultant Africanized honeybees are discussed later on.

Traditional beekeeping was practised in many parts of the region, with stingless bees (Meliponinae); the honey that Columbus records in 1492 was probably from *Melipona beecheii fulvipes*. The methods used cannot be directly transferred to honeybees, because their nest structure is different. Partly for this reason, a much higher proportion of beekeeping is (and has been) with modern movable-frame hives here, than in Africa where traditional beekeeping used honeybees.

Some of the countries here are relatively large producers of honey, with considerable capital investment in beekeeping. Not much of this honey is consumed domestically, by tradition; most is exported, the largest exporters being (in order) Mexico, El Salvador, and Guatemala; Brazil has now also started to export honey. There are also many small islands in the Caribbean, each with its own special characteristics for apiculture.

Two *Satellite Bibliographies* deal with beekeeping and bee research in Mexico (S/29) and Brazil (S/30). Most of the publications from Mexico deal with beekeeping and closely related subjects, whereas the 159 from Brazil have a strong element of bee genetics, largely because of the outstanding leadership of Professor W. E. Kerr at the University of S Paulo at Ribeiro Prêto, and as Director of INPA at Manaus from 1975 to 1978.

## 6. Southern Latin America (106 publications)

There are seven other countries of America south of the Equator. Argentina, the largest, is one of the world's most important honey exporters, and has for some time supported scientific development and research work; *Satellite Bibliography* S/31 'Beekeeping and bee research in Argentina', gives 95 references. Like Brazil, and Egypt and India in the Old World, Argentina should be in a position to provide technical information and training for personnel from neighbouring countries.

The honeys and bee plants of Argentina have been fairly well studied, but similar information from the rest of the region is largely lacking and is urgently needed.

## 7. The Pacific area (85 publications)

Although the Pacific Ocean covers a larger area than all the earth's land masses, there were no honeybees on any of the islands there until the 1850s. The history of beekeeping being entirely recent, there is much less to report than in the other regions. Only *Apis mellifera* has been used, and developments have been fairly well documented in published material. Louis Hitchcock has sent IBRA a splendid dossier on the background to beekeeping on Wake Island, an atoll only 8 sq km in extent.

Many of the islands are now actively concerned with the possibility of developing their beekeeping potential, and most of the expertise and financial aid has so far come from New Zealand, with some from Australia. Certain other Pacific islands are still without honeybees, and are of potential interest for this reason. No handbook for beekeeping in the Pacific area has yet been published, nor any substantial survey of the subject.

Papua New Guinea is included here, but Indonesia and other islands off the coast of Asia, with the Philippines, are in 4 above. Australia and New Zealand are outside the scope of the *Bibliography*.

## Honeybees in the tropics

### 8. *Apis mellifera* of European and Asiatic origin (189 publications)

*Apis mellifera* from Europe has been introduced into almost every region of the world. All the world's main honey-producing countries—Argentina, Mexico, China, the USA, USSR, Canada, Australia and New Zealand—use *Apis mellifera* of European origin, which is also still used throughout Europe. Attempts to introduce European bees into the full tropics of Africa and (with notable exceptions) those of tropical Asia have not succeeded, for complex reasons that are still only partly understood.

*Apis mellifera* is native to the Arabian peninsula, Mediterranean islands, and Asia from its western shore as far east as Iran.

### 9. *Apis mellifera* native to Africa (264 publications)

The African continent has an enormously rich variety of *Apis mellifera*, which are referred to by various authors as subspecies, types, races, and so on. The Sahara desert forms a barrier between bees to the north, of which *Apis mellifera lamarckii* (formerly *fasciata*) is in the Nile Valley and *A. m. intermissa* west of the Libyan desert. Cape Province at the southern tip of Africa has *A. m. capensis*, and islands to the east (Madagascar, Réunion and Mauritius) *A. m. unicolor*. Throughout the rest of Africa, bees have mostly been referred to as *A. m. adansonii*, unfortunately also often called the African bee, as if it were the only one in the continent.

The situation was first described well by F. G. Smith in 1961, and he was able to show that it was much over-simplified. More recent attempts have started to unravel the genetic layout of honeybees of the wide group traditionally referred to as *A. m. adansonii*, and reports of progress so far are included in this Part. It will be many years before enough information can be collected and analysed to provide a coherent picture.

Some of the African honeybees have characteristics that are most valuable to beekeepers, but many of the bees are difficult to handle. Bee breeding would seem to offer great opportunities for increasing the pleasure and profitability of beekeeping in Africa. It is by no means easy, but the first important step is to piece together the distribution of different types of African honeybees. This requires the collection of samples of bees whose origin is adequately documented, from a very large number of localities, and readers are asked to co-operate in providing samples if they are requested to do so.

### 10. *Apis mellifera* hybrids, known as Africanized bees, in America (140 publications)

Bees commonly referred to as *Apis mellifera adansonii* were introduced from South Africa to São Paulo in Brazil in 1956, and have since spread through much of the

South American continent to the north and west; in the south, they have halted at about the 10°C winter isotherm. This spectacular movement took place through regions where European *Apis mellifera* was already widespread, and through others where it had never penetrated. The spread has been disadvantageous in that upon occasion the 'Africanized' bees can easily be alerted to sting people and animals; such incidents have been reported in the press, often in a sensational way. On the other hand, in the tropical part of the continent Africanized bees can store much more honey than bees of European origin; after the Africanized bees have been in an area for a few years the beekeepers can get much higher honey yields, provided they have learned how to adapt their management methods to suit the new bees.

The northerly advance of these honeybees of tropical origin has been regarded with concern in official quarters in the United States, and with alarm among a good many of the populace who have been supplied with exaggerated and misleading stories. If the advance is maintained through Central America and Mexico to the USA, the honey and crop-pollination industries there might well be affected. Much scientific attention has therefore been directed to the whole situation, and many publications from the USA are included here.

African bees have in fact been introduced upon other occasions to the USA and to several European countries; this caused no stir at the time, because the bees were less well adapted to their new environment than the bees already there. In South America the new tropical bees were competing in the tropics against bees of European (temperate-zone) origin. Their success is little to be wondered at, although its extent still constitutes a spectacular biological event. It also offers an urgent warning of the possible hazards of moving honeybees around the world.

### 11. **The Asiatic hive bee *Apis cerana*** (192 publications)

*Apis cerana* is the Asiatic counterpart of *Apis mellifera* in Europe and Africa; it is referred to in some earlier literature as *Apis indica* or *Apis indica japonica*, according to origin. Both *Apis cerana* and *Apis mellifera* nest in cavities, and both are exploited by beekeeping (or by honey hunting) throughout their range. *Apis cerana* is often thought of as a tropical species, but it has spread and occupied territory east of the Himalayas to the Pacific as far north as Japan and the Far Eastern Province of the USSR (latitude 45°N). In the west, *A. cerana* reaches as far as eastern Iran.

Understandably, in view of its distribution, *Apis cerana* has been much less studied than *A. mellifera*, but investigations are now under way in Asia, and in Europe where experimental colonies have been maintained both in the open and in flight cages.

Where either *A. mellifera* or *A. cerana* has been imported into the territory of the other, *A. mellifera* is liable to oust *A. cerana*; this is not a straightforward question of mating, since the two species cannot interbreed, but if *A. mellifera* drones are present in large numbers they may attempt to mate with *A. cerana* queens (the sex attractant pheromone is the same) and thus prevent *A. cerana* drones from doing so.

*Satellite Bibliography* S/32 reports 93 further publications dealing with 'Laboratory studies on *Apis cerana*'.

### 12. **The giant honeybee *Apis dorsata*** (97 publications)

*Apis dorsata*, the largest of the honeybees, is also known as the giant bee or as the rock bee, from its habit of nesting beneath overhanging rocks. It is a tropical species, found throughout south-east Asia and the Indian sub-continent. The considerable honey stores in its single-comb nest, built in the open, are harvested by honey hunters,

who face a variety of hazards in their work. The bees themselves can be fearsome if they are alerted to attack. In some areas the only access to the nests may be from the top of a cliff, in which case the hunter is lowered down the cliff face on a rope. Or the nests may be in forests such as the Sundarbans at the mouth of the Ganges, where tigers not infrequently kill honey hunters. For many years attempts have been made to keep *Apis dorsata* in hives which can be transported and controlled to some extent, and a certain success has now been achieved.

*Apis dorsata* is of economic importance as a producer of honey and wax. Early anecdotal information about this bee has now been replaced to some extent by more scientific studies, and the general publications are therefore presented in two groups, before and after 1950. Eighty further publications deal with both this bee and *Apis florea* (see below).

### 13. **The little honeybee *Apis florea*** (116 publications)

This bee, the smallest of the honeybees, is often regarded as the most primitive of them. This may well be true, but so far it is less well known than other *Apis* species. Some scientific work has, however, now been done, and when the behaviour patterns and way of life of *Apis florea* are better understood, it may perhaps not seem quite so primitive.

*Apis florea* is a tropical species, its distribution stretching throughout south-east Asia and the Indian subcontinent, and as far as Iran and Oman. It builds a single-comb in the open, or in the shelter of a cave. In parts of Oman it has also been traditionally 'kept' for honey production by beekeepers. *Apis florea* and *Apis dorsata* have many characteristics in common, and they have often been studied together. Of the 116 publications referred to, 80 deal with both species.

### 14. **Beekeeping in the tropics with stingless bees** (111 publications)

The stingless bees (Meliponinae) are tropical social bees, and there are several hundred species. Most of them store honey and pollen in wax cells that are much more irregularly constructed than combs made by honeybees. Some species have nevertheless been kept in man-made containers, and natural nests of many others have also been exploited for their honey and wax. There is a long history of man's use of stingless bees in all tropical regions, especially in the Americas, where they were the only source of honey and beeswax until European bees were introduced in the 1800s. Most of the advances in methods of keeping stingless bees in hives have been made in the Americas, the African tropics coming second. The simplest 'hives' are gourds, clay pots or hollow tree trunks, but purpose-built wooden boxes have also been developed that make it easier to harvest honey without interfering with the brood.

Stingless bees produce a wide variety of honeys, not all as palatable as honey from honeybees, in that the bees may forage on many different raw materials, not only nectar, honeydew and pollen. The water content of the honeys may be much higher than in honey from honeybees, and the yield from each colony small. Nevertheless, some honeys from stingless bees are highly prized.

With so many species of stingless bees, much knowledge exists, and much more remains to be discovered. *Satellite Bibliography* S/33, 'Biology of stingless bees', gives details of 224 further publications, many being scientific studies on the social life and behaviour of different groups of these bees.

## Energy resources for bees

### 15. **Bee forage in the tropics** (170 publications)

All honey is produced from plant materials, and its characteristics depend on the identity of the forage plants used by the bees. Most plants also provide bees with their essential protein food supply, in the form of pollen; some provide honeydew, and some provide propolis. The plants that constitute the food resources of honeybees in the tropics have been less studied and evaluated than those in temperate zones. Nevertheless, much has been published about them, and Part 15 cites publications that deal with one species, or a group of related species, in some 40 plant families.

Reports have been written about the bee plants of many individual tropical and subtropical countries, at varying standards, and 246 of them are listed in *Satellite Bibliography* S/34, 'Bee forage in specific regions of the tropics', which follows a similar geographical sequence to Parts 1-7 of the *Bibliography* itself.

## Bee management and health

### 16. **Beekeeping management and equipment in the tropics** (326 publications)

The fundamental principles of beekeeping management are similar all over the world, and the two species of bees that are used, *Apis mellifera* and *Apis cerana*, are very closely related. For successful management, yielding the maximum harvest in the area in question, the colonies must be managed to take advantage of local nectar flows and other conditions, and to sustain healthy survival through dearth periods: this is where the skill of the beekeeper comes in. No two areas in the world are exactly alike for beekeeping, but many are sufficiently similar for experience in one to be useful in another. Part 16 of the *Bibliography* brings together information from many tropical areas on individual aspects of bee management.

There is no single 'best hive' for bees everywhere in the world: hives are chosen for both the convenience of the beekeeper, and the needs and capabilities of the bees. But there is often a best hive for a certain set of conditions, so it is essential to have the fullest possible information before starting on any sizable undertaking, for after a hive has been chosen, a subsequent change may be very costly. If such information is lacking, the best choice may well be whatever is in use in the area. Knowledge and experience of other local beekeepers can then be called upon to the full, and hive parts will be interchangeable, including combs with brood and bees.

No textbook is yet available that deals comprehensively with bee management in all tropical regions.

### 17. **Indigenous materials, methods and knowledge relating to the exploitation of bees in the tropics** (191 publications)

We must not too easily dismiss the past as something to be replaced by innovations regarded as better simply because they are new, or because they come from a country that is regarded as worth copying. In almost all regions of the tropics there is a long history of man's harvesting honey (and later beeswax), and some of the methods by which colonies of bees were installed and managed in hives are ingenious and effective; almost all involve little if any outlay of money.

The enthusiasm for the new "rational" movable-frame beekeeping that ran through the countries of the temperate zones between 1850 and 1900 tended to make all things



new, and to regard earlier methods as outmoded. This outlook is now having to be modified, partly because of the rocketing costs of movable-frame hives and frames, and partly because of the balance between the relative honey and beeswax yields. With traditional methods, in which whole combs were harvested, the beeswax yield was about 15-20% of the honey yield. In modern methods the combs are re-used, and the beeswax yield consists mostly of the cell cappings—between 1% and 2% of the honey yield. This amount of beeswax is absorbed within the beekeeping industry; the beeswax needed for other purposes (cosmetics, pharmaceuticals, polishes, armaments) is all produced by traditional methods.

Because of these practical and economic factors, as well as the awakening interest in endangered cultures, an increasing number of people are now seeking information about traditional beekeeping and honey hunting, and are themselves adding to this knowledge through ethnological and anthropological studies, and through the discovery and analysis of rock paintings.

In general, Africa has the oldest and richest tradition of beekeeping and honey hunting with *Apis mellifera*; Asia has widespread but less well studied traditions with three tropical species of *Apis* that exist nowhere else (*cerana*, *dorsata*, *floreana*); and tropical America has a rich heritage of beekeeping with stingless bees (meliponins). In Australia stingless bees—and honey ants—were exploited, and only in the Pacific area was primitive man without honey and beeswax.

## 18. **Bee diseases, enemies and poisoning in the tropics** (283 publications)

In the study of organisms which affect the health of bees, an arbitrary distinction (in terms of size) is often made between enemies, which are generally visible to the naked eye, and diseases, which are caused by microscopic pathogens. In general, honeybee colonies in the tropics suffer more injury and mortality from visible enemies than from diseases caused by invisible pathogens. In the temperate zones the reverse is true, and much more scientific research has thus been done on the diseases of honeybees than on their enemies. The word 'enemy' is not a very satisfactory term, but it can be used to include predators that attack live bees (e.g. *Philanthus*), parasites (e.g. *Varroa*) and organisms that attack the colony structure (e.g. *Galleria*) or food stored within it (e.g. *Carpoglyphus*). The few publications on commensals (e.g. *Melittiphis*) that may live in the colony without being harmful, are listed with the enemies.

An up-to-date and competent scientific book was published towards the end of 1978, 'Honey bee pests, predators and diseases' edited by R. A. Morse, with individual chapters are written by 16 specialists in the USA and Canada. The book is concerned primarily with the USA, but it refers to all the diseases and many of the enemies of honeybees in the tropics. *Satellite Bibliography* S/35 provides 169 further references on 'Bee diseases and pests in specific regions of the tropics'. Both these publications can be obtained through IBRA.

## **Bee products**

### 19. **Honey in the tropics** (172 publications)

Almost all the areas in the world whose potential for honey production is still unexploited lie in the tropics. Yet honey can be produced on a small scale, for domestic consumption or as a cash crop, by people in rural areas almost everywhere, however little land they have. The cost of doing this can be minimal, although some expenditure

can lead to much larger returns. Some tropical countries actually import honey, when they could produce all they need with little effort.

Honeys from the tropics share many characteristics with honeys from the temperate zones, and these have been well studied. The book 'Honey: a comprehensive survey' collected together all the useful information that could be found up to the time of its publication (1975), and special efforts were made to include material on the sources and characteristics of tropical honeys. We do not yet have a complete knowledge of these honeys.

*Satellite Bibliography* S/36, 'Honeys of specific regions in the tropics', is organized in the same way as Parts 1-7, and contains 113 entries, of which 34 are laws, statutes, regulations and standards.

## 20. **Beeswax and other hive products in the tropics** (146 publications)

Traditionally, beeswax was the primary harvest to be sold from colonies of honeybees in the tropics, and much of the world's supply has come from Africa south of the Sahara. Beeswax has received far less attention than honey, and less is known or published about it. There is, however, an acute world shortage of beeswax, with consequent high prices. The use in the tropics of movable-frame hives, which suppresses beeswax production, may therefore have to be re-evaluated, since beeswax can be produced most easily in tropical conditions.

Propolis, a sticky resinous material collected by bees from certain plants, and once regarded only as tiresome adulterant of beeswax, now fetches quite high prices for the pharmaceutical industry. Pollen, collected by bees in large quantities, is similarly used; weight for weight it is much less expensive to harvest. Royal jelly and venom are secretions of the bees, as beeswax is, but they are expensive since only small quantities are produced, and they are difficult to harvest. They, too, have interesting biological properties.

Finally, bee brood can provide a nutritious food for man and for his livestock. The sale of queens, alone or as a 'package' with a kilogram of adult worker bees, is a flourishing industry in the warmer parts of the temperate zones. It has not yet been extended to the tropics, and the widespread concern about the possible introduction of parasites with imported bees may even prevent such a development.

## 21. **Descriptions of pollen grains in tropical honeys** (161 publications)

Whereas honey sources of both north and south temperate zones are well documented, those of the tropics and subtropics are not. From both economic and scientific viewpoints, there is an urgent need for their better identification according to plant source. One important method for doing this is the identification of the pollen grains in the honeys, and the *Bibliography* provides access to the literature on this subject. It also gives information on pollens of plants from forty botanical families that are important to bees in the tropics and subtropics; plants are listed alphabetically under family.

*Satellite Bibliography* S/37, 'Pollen grains of some further tropical plants', enlarges the list with 111 further publications that may well be relevant to honey and to pollen sources used by bees.

## **The role of bees in agriculture**

### 22. **Bees for pollination in the tropics** (179 publications)

Bees, especially the honeybees we are mainly concerned with here, are essential for

the production of certain crops, and many other crops requiring insect pollination can in practice be serviced adequately only by taking hives of honeybees to them. Then there are crops that give higher and better yields if bees are provided in sufficient numbers. So provision of bees can be an insurance against crop failure, and an investment repaid many times over by increased financial returns.

Two books are outstandingly useful sources of information on insect pollination in general, 'Insect pollination of crops' by Dr. J. B. Free (1970) and 'Insect pollination of cultivated crop plants' by S. E. McGregor (1976); both are in print and can be obtained through IBRA. *Satellite Bibliography S/38* 'Bee pollination in specific regions of the tropics' provides details of 209 studies, including those carried out in the tropics on crops that also grow at higher latitudes.

## The tropical regions in perspectives

### 23. Apicultural development programmes

It was originally planned to list all publications about beekeeping development programmes in this Part. However, grant-aid has generously been provided by the aid agency of the German Federal Republic, Deutsche Gesellschaft für Technische Zusammenarbeit (GTZ) GmbH, for the preparation and publication of a much larger book, 'Beekeeping aid programmes: directory and guidelines for evaluating new programmes'. The book, to be published in 1980, will give some details of up to a hundred beekeeping aid programmes past and present, together with guidelines written by Professor W. Drescher and others, to help persons who need to plan or evaluate new programmes. The book will have about 150 pages, and will be illustrated with photographs in colour and in black and white.

### 24. Miscellaneous indexes, acknowledgements, etc (98 publications)

The contents of Part 24 are heterogeneous, and its title may seem to indicate triviality, but it is an indispensable Part of the *Bibliography*, and will be referred to constantly when using other Parts. It has a complete author index, an index of countries in Parts 1-7, and three maps showing the 184 countries covered. A number of publications of world-wide (or tropics-wide) importance were not appropriate for inclusion elsewhere, and Part 24 includes a list of standard text-books and beekeeping journals that represent a basic reference collection for any apicultural library. All books listed are in English, and in December 1979 were in print and among the selection for sale stocked by IBRA.

Although my name appears as author, and the responsibility for planning and execution has been mine, the *Bibliography* could not have been prepared without the co-operation received from many sources. My most sincere thanks are due to all participants, both the apicultural specialists in different countries, and the staff at IBRA. Together we have, for the first time, provided access to the large amount of knowledge on beekeeping throughout the tropics. In the future, as in the past, a development programme may have to be set up without all the necessary information, but never again need this be done without the information that already exists.