

## BEEKEEPING IN AFRICA

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### I. North, East, North-East and West African Countries

#### Abstract

The recent status of beekeeping in North Africa: Algeria, Egypt, Libye, Morocco, Tunisia, in East Africa: Kenya, Tanzania, Uganda, in North-East Africa: Djibouti, Ethiopia, Somalia, Sudan, in West Africa: Benin, Burkina, The Gambia, Ghana, Guinea, Guinea-Bissau, Ivory Coast, Liberia, Mali, Niger, Nigeria, Senegal, Sierra-Leone, Togo, are described. Races of honeybees, including African honey-bees, bee forage plants, activities of honeybees, honey production, pests, diseases of honeybees, honey hunting, traditional beekeeping using traditional hives, modern beekeeping using modern hives, in these 26 countries, are included in this work. History of beekeeping, research activities, and pioneers of beekeeping research in these countries except: Mali, Niger, Sierra-Leone, are included. More research was conducted in Egypt, Tanzania, Ethiopia, Nigeria, Senegal. Projects, associations, training courses, books, seminars, workshops and conferences, are summarized. More organization, co-operation, modernization, training, extension and research, are needed.

#### Introduction

In Africa, temperatures are high in certain Northern Tropical Zones, however, they are modified by the height of the mountains of East Africa. About 10% only of the total world population is found in Africa. The greatest populations are found in Nigeria, Ethiopia, Egypt and near the East African lakes. Of the total area of Africa, 20% is covered by forests and 40% by savannas, while the rest 40%, forms the desert. The agriculture includes palm-oil, ground-nuts, cocoa, cotton and rubber. The areas with a Mediterranean climate produce grapes, oranges and other fruits and vegetables. East African Nations export tremendous quantities wax. Ethiopia and Tanzania produce about 2.5% and 1.15% of total world honey production, respectively. Keeping bees in beehives as practised in Egypt, Kenya, Tanzania, is not well known in other part of Africa[8].

#### Research Work

The area of North Africa contain the cradle of the craft of beekeeping, pictorial records in Egypt exist from 2400 BC onwards. Bees have been studied in Egypt to a much greater extent than elsewhere in North Africa (Table I). More research in East Africa was in Tanzania, in Ethiopia in North-East Africa and in Nigeria, Senegal, in West Africa[32].

Table I

Beekeeping research in North, East, North-East and West African Countries

Country*	Number of published entries	First publication in beekeeping	Pioneers in the field of beekeeping
N. Africa			
1. Algeria	17	Doumas (1903)	Doumas, Alber, Andreu, Grissinger, Idir, Jenn
2. Egypt	143	Abushady (1949)	Abushady, Mellor, Wafa, Rashad, Hassanein, Mazeed, Hussein
3. Lybia	6	Brittan (1955/56)	Brittan, El Banby, Mazeed
4. Morocco	27	Haccour (1939)	Haccour, Aloyol, Barbier, Crane, Chapot, Faress, Ruttner
5. Tunisia	17	Chenevard (1929)	Chenevard, Matis, Osman, Paterson, Boderballa
Total	210		
Mean	42		
E. Africa			
1. Kenya	11	Huntingford (1955)	Huntingford, Kigatiira, Nightingale, Riley, Mwaniki
2. Tanzania	23	Culwick (1936)	Culwick, Bruijn, Drescher, Hunter, Smith, Ntenga
3. Uganda	12	Kerr (1914)	Kerr, Fagg, Chorley, Driberg, Johnson, Roberts, Lind
Total	46		
Mean	15.3		

N.E. Africa			
1. Djibouti	1	Yeates (1978)	Yeates
2. Eriythrea	1	Scott (1954)	Scott
3. Ethiopia	13	Julien (1918)	Julien, Ambatchew, Giavarini, Griaule, Mammo, Scott
4. Somalia	3	Paterson (1970)	Paterson, Leuthold
5. Sudan	9	King (1920)	King, Marshall, Paterson, Kambel, Rashad, El-Sarag
Total	27		
Mean	5.4		
W. Africa			
1. Benin	1	Potiron (1972)	Potiron
2. Burkina-Fasso	2	Swanson (1976)	Swanson
3. Gambia	7	Brooks (1927)	Brooks, Hall, Saunders, Tallantire
4. Ghana	13	Collins (1942)	Collins, Doku, Gornez, Kaufmann, Anno, Adjare
5. Guinea	4	Pogeguin (1906)	Pogeguin, Matis, Mitev
6. Guinea-Bissau	1	Abelhas (1968)	Abelhas
7. Ivory Coast	3	Darchen (1973)	Darchen, Bornek
8. Liberia	2	Clulow (1969)	Clulow
9. Nigeria	17	Lamb (1927)	Lamb, Atfield, Ayuode, Burns, Collins, Corby, Taylor, Sowunmi
10. Senegal	17	Linder (1965)	Linder, Darchen, Douhet, Lavy, N'Diaye, Peled
11. Togo	2	Petitjean (1975)	Petitjean
Total	69		
Mean	6.3		
G. Total	352		
G. Mean/country	14.7		

(\*) No information about beekeeping from Green Head Island, Mali, Mauritania and Niger[32]. (+) A report about the country[32].

Table II

**Beekeeping in North, East, Nort-East and West African Countries**

Country	Area (1000 km <sup>2</sup> )	Bees	No. M.H. (1000s) (year)	No. T.H. (1000s) (year)	No. colonies per km <sup>2</sup>	M.B. (year)	No. beekeepers (1000s) (year)	No. colonies/bee-keeper	Total honey (tonnes) (year)	Mean honey (kg)/(colony)	Popu-lation (1000s) (year)	Honey (gm)/person
N. Africa												
1. Algeria	2382	Ami*	500 (1997)	100 (1997)	0.25	(1995)	70 (1996)	8.57	800 (1994)	1.33	28400**	28.2
2. Egypt	1001	Amla, Amc, Aml	1119 (1994)	124 (1994)	1.24	(1880)	110 (1994)	11.30	9112 (1994)	7.33	61900	147.2
3. Libya	1760	Aml, Amc	50 (1996)	few	0.03	(1995)	3 (1996)	16.70	500 (1996)	10	5200	96.2
4. Morocco	447	Ami, Amsa	30 (1994)	370 (1994)	0.89	(1960)	27 (1994)	14.80	4400 (1994)	11	29200	150.7
5. Tunisia	164	Amc, Ami	47 (1996)	138 (1996)	1.13	(1957)	10 (1995)	18.50	1445 (1996)	7.8	8900	162.4

E. Africa												
1. Kenya	583	Ama, Aml, Ams, Amm	2100 (1984)	100 (1985)	3.60	(1955)	(-)	(-)	11970 (1985)	5.7	28300	423
2. Tanzania	945	Ama	1500 (1982)	most (1982)	1.60	(1950)	(-)	(-)	11550+	7.7	28500	405.3+
3. Uganda	236	Ama	43 (1984)	most (1984)	0.18	(1978)	(-)	(-)	172+	4	21300	0.008+
N.E. Africa												
1. Ethiopia	1222	Amab, Amy, Ams, Amm	2520 (1984)	5000 (1996)	2.10	(1970)	1000 (1976)	7.52	23000 (1996)	8.3	56000	410.7
2. Somalia	638	Amla, Amc	few (1986)	100 (1986)	0.16	(1970)	3 (1995)	33.30	350 (1995)	3.5	9300	37.6
3. Sudan	2506	Amc, Amsu, Af	50 (1994)	250 (1994)	0.12	(1960)	50 (1994)	6	1800 (1994)	6	28100	64.1

Table III

**Beekeeping in North, East, North-East and West African Countries**

Country	Area (1000 km <sup>2</sup> )	Bees	No. M.H. (1000s) (year)	No. T.H. (1000s) (year)	No. colonies per km <sup>2</sup>	M.B. (year)	No. beekeepers (1000s) (year)	No. colonies/bee-keeper	Total honey (tonnes) (year)	Mean honey (kg)/(colony)	Population (1000s) (year)	Honey (gm)/person
W. Africa												
1. Benin	112.6	Ama	4.3 (1986)	4.1 (1986)	0.04	(1972)	(-)	(-)	(-)	(-)	5400	(-)
2. Ghana	239	Ama	600 (1986)	most (1986)	2.50	(1964)	(-)	(-)	(-)	(-)	17500	(-)
3. Guinea-Bissau	36	Ama	20 (1984)	132.3 (1989)	0.56	(1968)	(-)	(-)	1000 (1991)	15	1100	909.1
4. Ivory Coast	322	Ama	3 (1986)	2.5 (1986)	0.01	(1973)	(-)	(-)	(-)	(-)	14300	(-)
5. Mali	1240	Ama	501 (1982)	500 (1982)	0.40	(1985)	(-)	(-)	8408+	8.4	9400	894.5+
6. Nigeria	924	Ama,	700 (1950)	most (1950)	0.76	(1950)	(-)	(-)	(-)	(-)	111200	(-)
7. Senegal	197	Ama	20 (1940)	1000 (1997)	0.10	(1962)	20 (1997)	51	500 (1997)	10.1	8300	60.2
8. Togo	56.8	Ama	(-)	(-)	(-)	(1975)	(-)	(-)	(-)	10 (1998)	4400	(-)

*Ami*, *Apis mellifera intermissa*; *Amla*, *A.m. lamarckii*; *Amc*, *A.m. carnica*; *Aml*, *A.m. ligustica*; *Amsa*, *A.m. sahariensis*; *Ama*, *A.m. adansonii*; *Aml*, *A.m. litorea*; *Ams*, *A.m. scutellata*; *Amm*, *A.m. monticola*; *Amab*, *A.m. abyssinica*; *Amy*, *A.m. yemenitica*; *Amsu*, *A.m. sudanensis*; *Amu*, *A.m. unicolor*; *Af*, *Apis florea*; \*\* *Population based on 1995 data. No information about Mauritania, Green Head Island, Djibouti, Erythrea, Gambia, Burkina-Fasso, Guinea, Liberia, Niger, Sierra-Leone*; (-), *No information*; +, *estimated number*.

Table IV

Honeybee pests and diseases in North, Est, North East and West African Contries

Country	Brood diseases					Adult diseases		Parasitic mites		Others								
	AFB	EFB	Sac brood	Chalk brood	Stone brood	Nosema	Amo-eba	Aca-rine	Varroa	Bee lice	Me-rops & birds	Wasps	Ants	Senot-aina	Wax moth & others	Lizards	Honey badger	Hive beetles
N. Africa																		
1. Algeria	+	+	+	+	+	+	+	+	+	+	+	+	+	-	+	-	-	-
2. Egypt	-	-	+	+	+	+	-	+	+	+	+	+	+	+	+	-	-	-
3. Libya	+	+	-	+	+	+	-	-	+	-	+	+	-	-	-	-	-	-
4. Morocco	+	+	-	-	-	+	-	+	+	+	-	-	+	-	-	-	-	-
5. Tunisia	+	+	+	+	+	+	+	+	+	+	-	-	-	+	-	-	-	-
E. Africa																		
1. Kenya	-	-	-	-	-	+	-	-	-	+	+	+	+	-	+	-	+	-
2. Tanzania	-	+	-	-	-	+	-	-	-	+	-	+	+	-	+	+	+	+
3. Uganda	-	-	-	-	-	-	-	-	-	+	-	-	+	-	+	+	-	-
N.E. Africa																		
1. Ethiopia	-	-	-	-	-	+	+	-	-	+	+	-	+	-	+	-	+	-
2. Somalia	-	-	-	-	-	-	-	-	-	+	-	-	-	-	-	-	-	-
3. Sudan	-	-	-	-	-	-	-	-	-	-	-	+	+	+	+	+	-	-
W. Africa																		
1. Ghana	-	-	-	-	-	-	-	-	-	-	-	-	-	-	+	+	-	-
2. Guinea-Bissau	-	+	-	-	-	-	-	-	-	+	-	-	-	-	-	-	-	-
3. Nigeria	-	-	-	-	-	-	-	-	-	+	+	-	+	-	+	+	-	+
4. Senegal	-	+	-	-	-	+	-	-	-	+	+	+	+	-	+	+	-	+

Ants, *Dorylus fulvus*, in Morocco; spiders, snakes and snails, in Tanzania; termites, mice, toads, in Ethiopia; A bacterium, *Serratia marcescens*, in Sudan; snakes, mice, *Merops bullockii*, the small hive beetle, *Aethina tumida*, the large hive beetles: *Oplostomus fuliginous*, *Rhizoplatys bituberculatus*, *Goniochilus bicolor* and *Diplognata gagates*, in Nigeria; paralysis virus in Egypt. After (22) and others.

Maximum mean number of articles in North, 42 entries/country; followed by East, 15.3; West, 6.3; and North-East, 5.4 entries/country, with a general mean of 14.7 entries/country.

Available information about beekeeping in 19 African countries are summarized in Table II. Pests and diseases of honeybees in 15 countries are in Table III.

**Beekeeping Work**

**I. North African Countries**

**1. Algeria**

History of beekeeping in Algeria from ancient times and the development of the horizontal hives was described. A sectional hive suitable for Algeria and its use from 1947 to 1950, was described[49]. Native bees and hives in Algeria were described[17]. Traditional hives from rocks and mud were found in Algeria deserts, with excessive temperatures and prevalent winds. In Algeria, modern hives are of "Langstroth" type, with some modifications because of hot weather. A good honey crop can be obtained from these hives.

Co-operatives are working hard in beekeeping. Research activities are conducted in "Institute of Small Animals"[40]. Chemical and botanical origin of Algeria honeys was studied[80]. Beekeeping is practised mainly in the North, where the floral diversity is ensured almost time. Southern Algeria is a homeland of over one million date palm trees[152].

Citrus plants, sunflower and many wild plants, are the main honey plants. Main honey flow occurs during February-May. Honeybees played important part in pollination of almonds. Isolated oasis in Algerian deserts can be used for rearing a pure strain. *Varroa* was first found in Algeria in 1981[45].

Information Services (Apiculture Component) Algeria/83/002, a project to contribute the establishment and consolidation of the "National Extension pro-gramme", local training was conducted[112].

## 2. Egypt

Pharaohs were the first to keep Egyptian race of bees in mud hives placed in piles. Migratory beekeeping was practised. Honey was the delicious food for the kings and nobles. It is mentioned in pharaonic papyri as an ingredient in medicines, and in Holly "Koran"[57]. Egypt is one of the countries with legislation and standard or codex, based on honey to be sold[33].

The Coptic Organization for Social Services has distributed thousands of modern hives in El-Minia and Assiut.Governorates in order to increase the in-come of the farmers[111]. Two main honey flows have place in Egypt during June from clover, and August-September, from cotton, and a minor flow from citrus in April. 70% of modern hives and 40% of traditional hives, are in Delta, from which about 60% of honey is produced, while 40% from Upper Egypt. Honeybees was utilized for the pollination of certain crops in newly reclaimed lands. Pollen supplements as well as sugar syrup are fed to the bees for building up populations for pollination[130]. The Egyptian race of bees is resistant to varroa and acarine, and more effective in pollination of some cultivated crops. Isolated Siwa oasis was used for propagation of this race. More than 250 modern hives and Kenyan top-bar hives were used[98]. *Varroa* has been identified in the Nile Delta[113]. An Arabic language review of scientific papers concerned *Varroa* was prepared by the author[56].

"4th International Conference on apiculture in tropical climates", was held in Cairo, 1988. A project (TCP/Egypt/5409) was initiated, meant to improve honeybees through better managements, control of diseases and pests, better queen rearing and artificial insemination.

More concentration of colonies in a limited cultivated area, lower quality of queens, pests, diseases and poisoning with pesticides are the main problems facing beekeepers in Egypt. Expansion of modern beekeeping in new reclaimed lands, isolated stations for queen rearing and planting of more honey plants are needed.

## 3. Libya

Traditional beekeeping was found in early times in "Jabal Akh-dar", while modern beekeeping is practised only from 30 years. There are two main honey flows. The number of colonies is increased by 20% every year. Beekeeping is practised in Northern Lybia and some Southern oases. 9 types of honey are prevalent, from which, Sidr, *Eucalyptus*, *Citrus honeys*. Migratory beekeeping is practised. Main honey plants are: *Acacia*, *Pinus*, *Cupressus*, *Thymus*, *Rosmarinus*, *Citrus*, *Eucalyptus*, and many wild plants. Honeybees make liberal use of propolis to keep out intruders. The successful introduction of modern beekeeping, nectar sources and types of honey produced were described[23]. Apistan and bayvarol were more effective than Manpu against *Varroa*. Using of plants for controlling of *Varroa* is of special merits[79].

A project was applied for strengthening of the Agricultural Research Centre (Apiculture), UFTN/Lybie/006, to assist the preparation of applied agricultural re-search programmes and to strengthen the efficiency, to provide support for the library and organization of computer services.

## 4. Morocco

Traditional beekeeping in baskets (20-30 litre size) are found in Morocco. A professional "Beekeeping Institution" is found[19]. In Morocco, there is to be found *Apis mellifera intermissa*, aggressive and swarming honeybee race. In South, in the Atlas Mountains, there is a pure yellow colour race, *A. m. sahariensis*. Bees which are kept in cavities of house walls are yellow-red, good tempered and excellent foragers[50]. Citrus, thyme, lavender, rosemary, eucalyptus, are the main honey plants.

A list of honey-yielding plants is included for Morocco, which is one of sub-tropics/temperate countries with legislation based on honey to be sold[31, 33].

There is a regional (Morocco, Tunisia, Algeria) "Improvement of Technical Capabilities in Apiculture Production" (RAB/84/003), to improve production and standard of living of rural population. A project for "Development of Womens Api-cultural Cooperatives" (TCP/Morocco/6653), to establish 4 demonstration apiaries and to provide training for women and development of Women's Apiculture Co-operatives also exists.

## 5. Tunisia

Availability of honey plants, is one of the beekeeping problems in Tunisia, and expansion of forests is one of the solutions. Co-operatives are also needed. Unarranged migratory beekeeping leads to dispersal of diseases and less honey production. Research team working in pests and diseases control, genetic improvement of bee race, pollination and bee products is needed. Extension and training are needed for development of beekeeping industry in Tunisia[43]. Instrumental insemination of Carniolan queens is conducted at a "German Station"[138].

During 1978, *Varroa* was discovered in Africa for the first time in Tunisia[133]. A project for promotion of beekeeping in the Sedjenane Region, for *Varroa* control is in progress. Privatisation of beekeeping associations was conducted. Introduction of improved management, with GTZ and another project about *Varroa* control, to develop biological control methods with GTZ were conducted. A training programme about "Bee Disease Diagnosis", was conducted in "Veterinary Research Institute", in May 1997.

## II. East African Countries

### 1. Kenya

Keeping bees in traditional hive, movable comb frameless hives, Kenya top-bar hive, and Tanzania transitional hive, in which comb are moved in pairs, were described. Kenya top-bar hive is successfully replacing traditional hive. The "David Hive" is more or less like Kenya top-bar hive, full honey combs are extracted. A planned research programme in bee selection in Kenya was suggested. 80% of Kenya-land, including some arid areas, is suitable for beekeeping. In Kenya, the imported European bees, suitably managed, were less useful than African honeybees. The foreign bees are confronted with competition in foraging and defence from African honeybees, which is well adapted to the tropical conditions[66, 67]. Traditional beehives are to be found in the Wakamba and Kalenjan, and proposed methods for improvement[114]. Traditional beehives are held by various tribes in the Embu District. There are economic life in Dorobo, hive designs in Kenya, and Kenya-Pilot Project[32].

In November 1984 "The 3rd International Conference on apiculture in Tropical Climates, was held in Nairobi. "Inventory of Non-Timber Forest products", was held in February 1996 in Nairobi. A regional Workshop organized and sponsored by Api-Promo/GTZ, was held in Nyeri, in 1997.

The observations recorded in the "Apicultural Section" of the "National Agricultural Laboratories" in 1971, indicated that beekeeping project can be expanded rapidly into a major source of income for farmers[68]. "Kenya National Beekeeping Station", was established in the Mount Elgon District of Kenya, for training 15 women's groups by "Swedish Mount Elgon Association", under funding from CIDA[20]. Main objective of "Kenya Indigenous Forest Conservation Project", in Nakuru, was to encourage beekeepers to adopt methods of extracting resources for hive production with minimal damage to the forest. "Baraka Beekeeping Project" was initiated in 1994, in Molo, with help of UK. "Baraka Agricultural College", has manufactured Kenya top-bar hives and other equipments. A beekeeping programme in Manu Forest with forest-dwelling "Ndorobo" beekeepers has been intensified and expanded[24]. In 1995, work at BAC is progressing very well with a new honey refining facility being built. "Beekeeping Courses" are becoming very popular.

"Commercial Insect Project" at the "International Centre of Insect Physiology and Ecology" (ICIPE), with the support of IFAD, is focusing on enhancing the productivity of commercial insects[129]. A project for forest conservation and income generation is based in Samburu District, in the semi-arid area of Kenya. ICIPE has included beekeeping in its research programme, in 1995. Dr. Herren hopes to integrate beekeeping in agroforestry farming systems[65]. Kenya advanced efforts to complement traditional hives, by propagation of Kenya top-bar hives, but irregularity of extension visits, costs of wood, and equipment, are limiting factors[27]. Out of 12 beekeeping co-operatives, 4 were managed by women's groups, e.g. "Kibwezi Women's Beekeeping Co-operative", formed in 1981. "Kitui Honey Refinery", which runs "Tana and Athi Rivers Development Authority" in one of the leading honey areas in Kenya is producing 1/3 of honey. Much of the honey proceeds from traditional hives, but they have a campaign to introduce Kenya top-bar hives[25]. "Ruai Beekeepers Co-operative" was set up in 1997. CIDA supplied materials and financial assistance for the 800 members, which mostly operating traditional hives. Between 6 and 8 tonnes of honey and 1.2 tonnes of wax/year are harvested. Using the bee space for African honeybees recommended by Tanzanian researchers, in 1950, frames for Kenya top-bar hives were made from hard and resistant wood of *Juniperus procera*[88]. Education, training and working of women as beekeepers, utilization of modern hives in Tropical Africa for honey production is recent, as compared with traditional beekeeping[69]. Traditional hives consists of a centrally split hollowed-out log, used by Turgen (Baringo). The upper section (male) is larger than the bottom section (female). During honey harvesting the female sections is detached to expose the upper fixed combs without damage[66]. The multichamber traditional beehive was described and the constraint in transforming traditional hives to modern hives which offer some solutions resulting in increased yields of better quality of honey[124, 125]. In Laikipia District, a frame for Kenya top-bar, and comb honey production,

were described. "Ruai Farm" motivates beekeepers to produce honey since 1977. From *Euphorbia candelabrum* and *Acacia mellifera*, it is possible to harvest "bitter honey" from traditional hives in September, and "sweet honey" in October, then in December there is mixed floral "grass" honey[99]. The brood nest arrangement in Kenya top-bar hives was described[149]. The communication dances performed by African honeybees clusters after vacating a nest was de-scribed. Exposed clustered colonies are more open to weather and predators, than colonies in hives or closed nests[70].

Canadian Projects aims to assist Kenyan Government to establish an "Apiculture Section" in the Ministry of Agriculture, by means of a co-operative programme of training, extension and research[66]. "Nyuki Newsletter", is the Bulletin of the "National Beekeeping Section", Ministry of Livestock Development, Nairobi. The "Beekeepers Guide Book" produced by the "Beekeeping Section" and "Kenya Beekeepers Association" is an informative, technical handbook on apiculture in Kenya.

## 2. Tanzania

Classical work on identification of pollen grains from 236 plant species, scale-hive records, discovery of European foulbrood, African "Dadant Hive", reasons for advocating it for, *A.m. adansonii*, production of high quality honey are included[141]. A report covers improvement of beekeeping in Ujamma villages, honey and wax production, hives and management methods for African honeybees, diseases (European foulbrood only), enemies[117].

Beeswax is a very important by-product of traditional beekeeping. Tanzania has been one of largest exporters of wax in the world. In 1973, 275 tons were exported. In Handern District, mean yield/traditional hive, is 15 kg honey. Assuming that 1/2 to 2/3 of harvested wax is obtained for export, the number of colonies must be between 800 thousands to a million. Modern hives were used in "Tanga Integrated Rural Development Programme", in north-eastern Tanzania and in Handeni, A beer, "pombe", is prepared from honey. A ratio of 1:15 between wax and honey provides a basis for calculation. Tanzanian-commercial hive and Tanzanian traditional hive are the two recommended blank hives. In order to avoid overcrowding, the carrying capacity of different areas must be investigated[39].

Problems of beekeeping programme are associated with man and his traditions, and with bees, and its enemies. Financial support is needed[118]. Training in Tropical beekeeping is conducted in "NJIRO Wildlife Research Centre, Arusha". They produce a "Newsletter" in beekeeping. A "Beekeeping Division" exists in Ministry of Natural Resources and Tourism[119]. Practical approach to beekeeping extension, methods of extension, targets and role of officers[120] are described. In 1987, the "Tanzanian Beekeepers Association" (TABEA) has been formed through the efforts of G. Ntenga, for development of Tanzanian beekeeping industry.

"Tabora Beekeepers Co-operative Society" (TBCS) was formed in 1962, with 100 beekeepers. Arusha Branch of "Wildlife Conservation Society of Tanzania", is funding "Hadza Beekeeping Scheme", to assist traditional hunters to sustainably use their environment through production of honey and wax. Care has to be taken when fire is used during harvest. From TBCS, Kipalapala, in 1991, 86.4 tonnes of "organic" honey were exported to UK and Netherlands. However, in 1995, only 10.6 kg honey was collected. In 1997, the following "Training Courses" were conducted: "How to teach beekeeping in Africa"; "How can we solve the problem of low productivity of East African Beekeeping"; "Training in beekeeping", in "Forestry Training Institute", Olmotoni; "Beekeeping in Rural Development", in Njiro Centre and Cardiff Univ., UK. Njiro Centre and B & D are co-operating on a project "Sustainable Beekeeping for Africa", funded by UK, DFID. 1st East Africa Workshop was held on "Tabora Natural Organic Honey", gathered without smoke. Nearly all honey is exported. Stored honey for a long time which means high HMF can sell as industrial honey with lower prices. In Njiro Centre, the best time of day to harvest honey combs from TBH is in the evening before dusk. When procedures are followed well, the best honey, with no venom can be obtained, with a few dead bees. El-Niño rains affected honey and wax production in June and August 1997 and 1998. Members of TBCS, reported that many colonies absconded and again occupied[89, 90, 91, 92, 93].

Traditional beekeeping among Wameru people of northern Tanzania. Social aspects of Ngindo beekeeping, "Tanzania-Canada Beekeeping Project" with CIDA, honey hunting and beekeeping situation in Tanga region, use of modern hives in development programme were summarized[32]. CLAUSS's book "The Bee-keeping Handbook" was translated to Swahili for Tanzania, in 1987[26].

Traditional beekeeping in Tanzania, is done side by side with other socio-economic activities. Stocking of traditional hive is left to chance, excepting baited hives. Maximum occupancy in: Lindi, Mtwara, Rungwa Game Reserve, where Tanzanian traditional hives and Tanzanian commercial hives are used with: baiting, transferring swarms, dividing established colonies, and using of emergency queen rearing during April and June, in lower plains and mountains. Beekeeping industry plays an important part of the economy of arid areas[75]. Twelve African honeybee races were described. *A.m. scutellata*, is superior to European races. Most African honeybee races abandon hives by reproductive swarming, migration and absconding. They defend themselves against intruders. With selective breeding we can have gentle bees. Foraging activity was studied at Njiro Centre. Beekeeping in the "Tanzanian Tropical Forestry Action Plan", was described. Aid was requested from "Overseas Development Administration", UK[71, 72]. Teaching beekeeping, research on African honeybee, using of propolis in medicine, in kilimanjaro region, are summarized[62].

"Arusha Beekeepers Association", held a meeting in October 1993. At Tabora, 1994, was a poor year for honey production. In this honey area, the estimated harvest of 360 tonnes could not be obtained due to lack of rain, and less than a tonne was harvested. Training in "Tropical Beekeeping" was conducted in Njiro Centre, in 1996. Fair rains, in 1999, were giving hope that the harvest would be good. TBCS were awaiting June for harvesting honey from Madaha's apiary in Malongwe Forest. The "let alone" method is discouraged by many beekeepers, but still the easiest way for catching swarms. In August 1998 and August 2000 "Bee-keeping in Rural Development" courses were conducted in Njiro Centre and at the Cardiff University, UK. The disadvantages of using modern hives with African honeybees, were discussed. A seminar was organized by FAIDERS, in Biharamulo, during 1997, to discuss modern beekeeping and tools to produce good quality bee products in increased quantities. "Arumeru Beekeepers Society", Usa River, and "Tree Planting Foundation" are promoting beekeeping in Usa River, Arusha.

In Tarangaire and Manyara National Parks, bees nests are located in hollow trees. The Gorowa and Iraqw beekeepers use a strongly scented plant, *Ocimeras suave*, to bait hives. Honey badger caused the decline of traditional beekeeping in some areas of bambati District. Barbaigs call honey beer "gesuda". Beekeeping is capable of further development[121]. Beekeeping camps of 6 to 15 persons are used over generations along Ugalla River. Individual beekeepers of TBCS can produce large quantities of organic honey, which is sold on international markets[48]. In Tanzania, 3 types of smokers are used: traditional locally made smokers, modern style smokers, and imported smokers. Ideal was a wide smoker with 2.1 litre volume, using elephant dung or papaya fibre[77]. Low cost gloves are made from available plastic tubes in Tanzania[100].

Honey production in Tanzania is dependant on small holders beekeepers, using traditional hives for African honeybees. Over 95% of beekeeping is practised in Savannah Forests "Miombo Woodlands", the rest is carried out in banana and coffee plantations, and where trees are used for hanging hives. Average productivity *A. m. scutellata* colony/year, using traditional hives, was 15 kg honey and 1 kg wax. Suggested formula for calculation of honey production using wax figures was discussed[73, 74]. Traditional uses of honey and wax in making remedies used to cure various diseases were summarized. A floral calender for beekeeping in North Tanzania was worked-up. Traditional beekeepers use various indicators to determine when it is time to harvest honey[84, 85]. The success of improved traditional hives beehive in field trials was discussed. A slight slope of the longside wall is necessary in order to reduce the degree of comb attachment. Traditional hives beehive, with 20 bars is recommended in North Tanzania. Entrance hole of 8 mm diameter, is ideal[51].

### 3. Uganda

Uganda has a very high potential for honey production, which not yet been fully achieved. Traditional beekeeping are in Teso and West Nile areas. Trees are the main forage plants, while in the Kigezi area, crops, pasture, weeds and exotic trees[134]. Introduction of modern beekeeping in Uganda was described[32].

A promotion programme with CARE, YMCA and Red Cross has been started to introduce more effective modern beekeeping in Uganda[109]. 4 major honey refinery plants in Nakasongola, Nalukolonga, Mbale and Soroti, 14 apiary demonstration firms are being established. "Uganda Beekeeping Association" (UBA) has recently formed in 1986 and 1st edition of their Newsletter was published with CARE-Uganda. "Apiculture Section" was established in Ministry of Animal Industry and Fisheries, Kampala. Apiculture Project CARE-Uganda, Kampala, was conducted. In 1990, beekeeping was started in Bunyaruguru County-Bushenyi. People are drinking their local brew mixed with honey. The UBA has embarked upon a "Beekeeping Research Project", which commenced in September 1995, in Luwero District, Kampala. They compared traditional hives with sloping sides, with straight sides, Langstroth hives with traditional hives instead of frames and traditional hives, concerning production, duration and susceptibility to pests and predators.

"Beekeeping Seminars", were conducted at the "District Farm Institute" Apiary Section, Ministry of Animal Resources. UBA held a seminar in Kampala[115]. "Kabarole Beekeepers Association, Fort Portal, is growing and spread to Buraghya, Buyangabo, Kibale, Mwunge[30]. A general meeting was held in Kabarole District. Main objectives are, beekeeping seminars in all counties, introduction of standard Dadant hives, erection of collection centres for honey and wax, marketing in the cities, such as Kampala.

"Tropical Projects Ltd", is a company that specialises in beekeeping extension, including 70 women, with the aim of collecting honey and wax in large quantities. They have 150 beekeepers and over 2500 colonies. Orders for honey were received from Arabia, France, Germany. Most hives are traditional hives, but they intend to acquire more Tanzanian beehives. UBA has over 200 members who are aiming together to achieve improvement in the quality and marketing of bee products[137]. "Atek Development Association", Soroti District, East UGA, undertakes beekeeping. Crops include beans, cassava, millet, peas, pigeon peas, simsin, sorghum and sweet potatoes. "The Apis Family Ltd", was founded in 1994, Nebbi District, North Uganda. They held a seminar in 1996, about marketing of honey and how to use Tanzanian beehives. "Beekeeping and Development Meeting", was conducted in April, 1997, Lira. "Katebwa Beekeepers" Group, Fort Portal, is inter-ested to contact beekeepers in other countries. "United Women's Apiary", (UWA) organized "Beekeeping Course", in Wobulenz[116]. In Kitgum the KWBA, hopes that together with its 300

beekeepers will be benefited from the "IDEA Project" through the UHA training and loan scheme. "The Uganda Honey Beekeepers Association" was formed in 1995. Honey and wax production can be more than doubted[122]. UHA is involved in a broad spectrum of rural beekeepers in Uganda and designed a programme of apiculture development, based on strengthening UHA coordination at national level, down to districts to villages establishing honey refining, for export grade bee products[123].

### III. North-East African countries

#### 1. Djibouti

Wild honey is collected and beekeeping should be practicable, if some one knew how to do it[151].

In 1988 "Apiculture Development Project" (TCP/DJI/6651), to evaluate potential for apiculture development in the country and consultancy services were offered.

#### 2. Ethiopia

Ethiopia is distinguished by 3 zones of climate, "Kolla", "Wonia Dega", "Dega". The "Kolla" or hot zone, where there are *Acacia*, *Albizzia*, *Combretum*, *Commiphora*, *Croton*. The "Wonia Dega" or cool-warm zone, where there are *Acacia*, *Coffea*, *Combretum*, *Croton*, *Guizotia*, *Trifolium*, *Olea*, *Veronia*. The "Dega" or cold zone, where there are *Olea*, *Rosa abyssinica*, *Albizzia*, *Gizotia*. Swarming takes place in September and April. In "Dega", flowering throughout the year, and bees have fewer enemies. While, In "Kolla", flowering period is short and bees are very productive and aggressive. In "Wonia Dega" bees are either those whose first very active productive swarms were caught in the low lands "Kolla"; or those un-productive swarms from "Dega". Honey production is estimated to be 26.547 tons/year. About 2/3 goes into "tej" making. Ethiopia ranks as third exporter of wax in Africa, after Tanzania and Angola. Gojam, is number one in number of hives and honey production. Only 30 beekeepers are using modern hives, at present[94].

Ethiopia is a potential beekeeping giant. In an Abyssinian grain-market, many honey bees were observed collecting from open sacks of shirro (*Cicer arietinum*) as a pollen substitute. The main usage of honey is for making "tej" and for selling. Honey hunting by Majangir and by Andaman islanders, beekeeping in Nakamte and Abyssinia, were described[61]. Ethiopia is one of the homes of *A. m. adansonii*. Bees are kept in traditional hives. Over 3 million traditional hives and one million farmer-beekeepers are in Ethiopia[94]. Beekeeping is divided into: beekeeping as practised in West and South Ethiopia, and beekeeping in the rest of Ethiopia. Majangir people used hollowed-out logs, taken from soft wood trees, *Cordia africana*. Hives were pulled up to high tree branches. Mean yield was 4-9 kg/hive in South and West, while in the rest of Ethiopia, as in Abyssinia, beekeeping is primitive. Traditional hives are used. Inhabitants of Tigrai, divided the hives into 2 parts, as in Kenya, one is honey chamber, for easier extraction. Abyssinian apiculture has its origins in Egypt. *A. m. fasciata*, probably existed in Abyssinia. Honey is harvested twice/year, before and after rainy season. Farmers place water near the apiary during dry period and pollen substitutes, during periods of pollen shortage.

In 1977, The "European Development Fund" was supporting a beekeeping project in Gambella District, where the honey from wild colonies, is the major component of the diet of Messango tribe. A "Beekeeping Development Project" was carried on Wolayita[139]. Beekeeping is a good way of development for Wolays people, modern beekeeping started some years ago, there are problems with diseases pests, wind and lack of knowledge about bee management. A project was initiated in 1988, about "Land Potential of Coffee and Oil Crops, Apiculture Component", (TCP/ETH/4521), to make preliminary assessment of the suitability of "Western Forest of Kaffa" for the production of crops, other than coffee. Another project in 1988 also, about "Assistance in Apiculture Development" (TCP/ETH/6763), to increase production of honey in Ethiopia through the introduction of modern beekeeping.

"1st Nat. Workshop" organized by "Beekeeping Unit" of Ministry of Agriculture, was held in May 1992, in Addis Ababa. Training was carried on by Ministry of Agriculture at Holeta, "Alamaya Agriculture University" and Addis Ababa University"; "Veterinary Faculty", also hold courses on Apiculture. In Holeta Centre, research was conducted in improving the quality of hive products, identification and development of races, evaluation of honey plants, improvement of traditional beekeeping and beekeeping equipment, and investigation of diseases. Equipment were supplied from the "Rural Technology Promotion Centre" and "Holeta Centre". Water content of Ethiopia honeys, was determined[64]. Gojjam and Gondar honey had a moisture content of 18.6%, which meet required standard, while that of Keffa and Sidamo had a 21% and above. Honeys from traditional hives had a higher moisture by 1.5-3% than that from modern hives.

The "Chika Hives" is used in Ethiopia, from mud, combining the basket beekeeping practised nearby or inside houses in Tigrai and Eritrea with modern hives, the 26 top-bars are made from bamboo. Most of modern hives (19000) are in the south-West and Central highlands[145]. Zander hive is the first, followed by Langstroth hives and Dadant hives.

Agriculture accounts 41% of GNP and 90% of foreign exchange earnings. About 3000 tonnes of beeswax are collected annually. In Ethiopia, where traditional beekeeping and honey hunting is still practised, the honey contains wax, pollen and other impurities, which affect the quality and market value of honey. African honey bees found at high altitudes in the Eastern mountains were classified as *A. monticola*[52].

Robbery is a real fetter of the development of beekeeping in rural Ethiopia and all beekeepers in developing countries. The increase of honey production in rural Ethiopia is important for the control of malnutrition in children[46].

### 3. Somalia

Some authorities speculate that bees came to Ethiopia from Egypt along the Nile Valley, and that the same bees were also taken to Somalia[94]. Somali bee-eater is one of the most serious pests of honeybee colonies in Somalia[82]. Beekeeping survey and recommendations for its possible development, were made on behalf of the "Somalia Agricultural Development Co-operation".

### 4. Sudan

Sudan is the largest country, in size, in Africa. Agriculture accounts for 40% of Gross National Product, and over 50% of its foreign export earnings. Main agriculture are cotton, peanuts, sorghum, barley, sesame, wheat and gum arabic. *A. mellifera* (indigenous and introduced from Egypt) and *A. florea* (introduced, probably from West Asia), and observed for the first time in Africa, November 1985, near Khartoum. Some biological and behavioural observations about this small bees were conducted[101].

Traditional beekeeping: clay pots, cylindrical log hives, Sudan bark hives, grasses woven into mats and rolled up, leaves of the doum palm "tangels". Modern low-technology, Kenya tops bar hives, Omdurman clay hives, Gufa basket hives and modern hives, are used in Sudan. The status of beekeeping in Sudan during 1978, was described[131]. Northern Sudan is desert, and indigenous honeybees do not exist north of Khartoum. In South, rainfall increases, and so does vegetation through savannah until finally the lush rain-forest near Sudan southern boundaries. There are thousands of beekeepers in Sudan. African honey bee is nesting in holes, trees, fallen logs, termite mounds, rocks and roofs. Differences in African honey bee characters from different provinces were observed. The native Khartoum bee was more aggressive than the Carniolan race, Blue Nile bees and hybrid colonies. Migration, swarming and superseding of the native honeybees was quite noticeable[132].

A bee hive was designed for usage by natives of the Southern Sudan[76], by developing of Khartoum and Omdurman hives. Detailed studies of bees and their hybrids with bees in Egypt were conducted. Honeybees and *Bombus* are the main pollinators[32]. Sunflower was the most affected by honeybee pollination, followed by lucerne and cotton[9]. Sudanese bees are highly defensive; cheap, light easily folded boots from local materials were made[18]. Peaks of brood rearing were during February and October. Pollen was collected from Talh, *Acacia seyal*, during January to March and Sunut, *A. nilotica*, in July to October. Curry tree, *Hypericum revolutum* is found in Sudan, Ethiopia, Kenya, Tanzania, Uganda and recommended for planting to increase honey production[47].

A project for refugees of Southern Sudan, was conducted in an area with good vegetation. They encouraged to plant trees supplied by UNHCR[87]. A bee-keeping project was conducted in Kubbum, the main centre of honey production in West Sudan, in 1986. Traditional beekeeping has long been practised here, where *Acacia* and other melliferous trees are found. Honey hunting resulted in destruction of colonies. With the increasing of desertification it is evident that hives must be prepared so that available timber is economically used. Education of beekeeping, 1600 farmers were trained, and low-technology bee-hive construction is the aim of the project. A number of projects were conducted in North and South Sudan. Demonstration apiary of Faculty of Agriculture, Shambat, Khartoum, was established.

Efforts to improve beekeeping in Sudan are summarized[41]. Modern bee-keeping is initiated by Faculty of Agriculture, University of Khartoum, where the Sudan National Council for Research and "Near East Foundation", jointly co-sponsored the training and research programmes. These 3 institutions formed the "National Beekeeping Project" (NBP). In 1987, a group of apiculturists and agriculturists formed the Sudan - Bee and Agriculture Voluntary Association". In 1987, a project is began in Kosti area for the small-scale farmers and honey hunters of the White Nile Agricultural Schemes. Most of people have accepted the project[147].

Because of high temperature, in Sudan, low percentage of mating success with baby nuclei was observed[41]. Adequate ventilation of mating nuclei is needed. The supplementary feeding of colonies is essential in April-August[102]. Sudan NBP was described[1]. In Kosti, Medani, Shambat, average honey yield was 7.5-22.5 kg/colony. *Eucalyptus*, is a good nectar source in April-June. Swarming, occurs in January-March and September, and coincides with the availability of *Acacia* pollen. Sudan colonies can issue 2-3 swarms/year[42].

## IV. West African countries

### 1. Benin

About 75% of Benin population earn a living from agriculture crops, that include, maize, cassava, sorghum, coffee, cotton, palm oil, peanuts, avocado, coconuts, guava, mango. Beekeeping in Dahome was described[127]. In 1994, the "Benin Integrated Centre for Tropical Beekeeping", CIAT, in Parakou, was introduced. CIAT, in the 3 years of activity, besides some projects, succeeded in training 384 persons. Besides, restoration of bee populations, massively destroyed by honey hunting, increasing the yearly income of the trained and assisted beekeepers, generating a mass conscience, and using beekeeping products on a large scale as food and medicine. "National Association of Beekeepers in Benin, Cotonou, is a member of "West African Beekeepers Association". Training available at CIAT and in Tobe, near Bassila. 10 projects have included beekeeping in their activities in the past 5 to 10 years.

Traditional beekeeping and modern beekeeping were used in Benin during 1998-1999 years. "3rd West African Bee Research Seminar" was held at Cotonou, in December 1995[21]. Plants visited by bees were listed[148]. Swarming of *A.m. adansonii*, occurs in September-October. Honey hunting is still practised as many colonies live in tree cavities or termite mounds or under large baobab trees, on branches or on the ceilings of houses. Calabashes, clay pots, gourds, hollowed out tree trunks and palm stems are used as traditional hives. In Somba Land, clay hives are built directly into the forks of trees and look like closed water pots. Traditional hives are made from cement, clay and wood. Cylindrical hives made out of iron sheets and insulated with a layer of straw, are used. Modern hives, including Dadant, the "France-Congo" hive, Langstroth hives, are used in few apiaries. Best honey harvesting from November to April. Most of honey comes from honey hunting.

### 2. Burkina-Fasso

Experiences with a recent project among the Gourmas in Upper Volta, was described[144]. In 1977, "American Peace Crops" started a bee-keeping project at a fruit growers' co-operative. An FAO-UNDP beekeeping project has been underway in Burkina-Fasso, since 1958, to promote use of traditional bee hives, with sloping sides and 24 top-bars, from timber or straw which is covered with cow-dung. Kenya top bar hives is the best for African honey bees. Beekeepers number has risen from 375 in 1986 to 2250 in 1989. Around 700 hives have been built so far.

"7th International IFOAM Conference" was held in Ougadougou, during January 1989. A project for "Apiculture Development" (TCP/BKF/4510), was implemented to improve honey production and to establish "National Centre of Apiculture". Another project was applied "Apiculture Development at farm Level" (TCP/BKF/5760), to increase honey production at farm level. "Intensification of Apiculture at Farm level" (BKF/87/016), is project to increase the income of 200 farmers/year, from the 2nd year of the project, particularly women and to improve their level of occupation.

Some African countries where experiments with intermediate beekeeping technology have been recorded are: Burkina-Fasso, Egypt, Ethiopia, the Gambia, Ghana, Guinea-Bissau, Kenya, Mali, Morocco, Niger, Senegal, Sudan, Tanzania, Uganda[142].

### 3. The Gambia

Gambia is a small country, located on the west of the African Sahel. Its people are subsistence farmers. Beeswax was the principal export. Traditional hives are used and 4 modern hives, Kenya top bar hives, Langstroth, Dadant and Zambian. There is a potential for beekeeping development.

A report, was published about 3 years study in Danish/Gambian beekeeping project and training programme, financed by DANIDA, and organized within the programme of co-operation between "Beekeepers Co-operative Association" in Gambia DANIDA, AFET, NGO, was formed to link and assist "Kaffos" and "Danish Beekeepers Association"[53, 96]. Basket hives from leaves of fan or rum palm, traditional hives are usually made from dead trees of fan or rum palm and santag[95, 96]. Traditional beekeeping includes killing of bees with fire during honey harvesting. Local and modern knowledge are in the training programme[53]. Honey can be harvested without destroying colonies to get more honey and secure strong bee population for pollination. Traditional hives are placed in trees after rainy season, October-November. Hives were left for 8-9 months before harvest. Using of modern hives and traditional bee hives, is needed. NBA was formed in 1996, to co-ordinate future activities. Individual ownership of hives should be encouraged and used for all new projects. Training and marketing must be effective and appropriate[97].

"Beekeeping in The Gambia" is a project by Action Aid - The Gambia (NGO), in 1980, and co-financed by ODA, Beekunda, Kiang West. By 1985, 13 apiary groups, with 200 hives had harvested, 1,103 litres of honey. Project aims to assist "Kaffos" to build "Bee Kundas", consisting of 3 huts, within an enclosure to accommodate an office for the beekeeping assistance, a storage hut, and a processing hut. "First West African Beekeeping Research Seminar", was held in November 1991, in Bakau, organized by

AFET. 70% of members are rural women. 9 West African Countries, participated. In Ghana, Guinea-Bissau, Mali and Senegal, beekeeping is promoted. "West African Beekeepers Association", now exists[34]. Queen rearing with African honey in Brikama, Gambia can be enhanced using the manipulative management feeding technique, which reduced the absconding[35].

#### 4. Ghana

Beekeeping in Ashanti, honey hunting, pollination by bees, efforts done in 1977, to promote beekeeping industry were reported[32]. The inhabitants of Central regions, Ekumfi District, have been practising traditional beekeeping. Bees are housed in clay pots. Some have as many as 50 "bee pots" "The Golden Insect" and "Beekeeping in Africa", are books for Ghanaian and other African beekeepers. For Ghana, plants visited by bees were listed[4, 8].

Ghana is a typical tropical country. Evergreen rainforest occupies the central part of Ghana. A narrow strip of the southern coastal lands as well as the northern areas, are covered with the savannah vegetation, that is rich bee forage. Traditional beekeeping based on using local materials, which vary with ecological zones (the forest and savannah zones), and with traditional beekeeping, that have been practised by ethnic groups (e.g. use of earthen pots as bee hives by Mid-Volta people). In Ghana and other parts of West Africa, the honeybee-man interactions, is the same as other tropical regions, where numerous species of bees occur. Honey hunters exploit feral nests of *A. m. adansonii*, as well as stingless bees. In West African subregion, honey season occurs from September to April and a minor peak in November-December. There is produced honey for local market.

Methods used in honey hunting, include, total, partial colony destruction prior to comb removal from the nest, separation of honey combs from brood, and straining, squeezing, burning or heating honey combs to extract the honey. Beekeepers that are using traditional bee hives adopted straining of honey. Quality of honey is related to time of year and the ecological origin of honey, within the country[12, 14]. Honey production for both the local and external markets, is important. Chemical analysis of honeys from different regions was determined, with the view of their use in food industry[38]. A method of daylight harvesting of honey, was adopted. Production of wax is urgently needed by many manufactures. At Kin-tampo[143], during work with Kenya top bar hives, leaves of cassava can be used as a bee repellent. The plant volatiles from *Adenia* have an anaesthetic effect on African honeybee[150]. Villagers utilize a certain vine, known locally as "bekyam" to subdue the bees[29]. At Adaklu, bees are colonising traditional hives from trunks of royal palm trees. However, these are difficult to inspect and beekeepers keen to use Kenya top bar hives, which can be made by local carpenters, gives more honey yield without contamination by smoke and ash and involves reduces bees attacks. Queen excluder can be used in these hives[11].

"Technology Consultancy Centre" (TCC) started its beekeeping programme in 1978, yet no government or aid agency had made any attempt to develop traditional beekeeping. From 1981 to 89, more than 20 "Beekeeping Work-shops" and short "Beekeeping Courses", have been organised when several Caucasian bee colonies were imported. TCC contacted Kenya and Tanzania for drawings of Kenya top bar hive which tested in savannah woodland. Beekeeping programme in Ghana has attracted other neighbouring countries 5 Regional Beekeeping Associations and Co-operative Societies, are now found. Boabeng Fiema Co-operative Society has been formed with the assistance of GTZ. One of the problems is that honey is not usually neatly bottled. Thus, educating beekeepers and honey-hunters to bottle their honey, is necessary[5, 6, 7].

"7th National Workshop on Beekeeping", Accra, November 1984, was organized by TCC. "International Beekeeping Course", Kumasi, September 1988, was organized by University of Science and Technology Workshop at Kpatinga, in 1990, for introducing modern beekeeping to northern rural communities. Extension visits were carried out in Tamale. Because of heavy rains, beekeepers were advised to feed their colonies, to enhance honey yield from February to March. GRATIS will finance the hives for Tamale ITTU. A bee club has been formed in Salt-pond, Central Ghana in 1990, to promote beekeeping. A workshop was held at Amissano[10]. "2nd National Beekeeping Conference", was held at Accra, in March 1995. "FAO Regional Office for Africa", based in Accra organized "Training Seminar on Beekeeping", at Ho, Volta Region, November 1996. Persons from 6 West African Countries, participate in it. The "African Peace Network", APNET, were organising a beekeeping workshop at Dansoman, in 1997. APNET, has a number of sustainable beekeeping farms in 110 districts, including Bron a Hafo. An "Information Centre" was established to serve Ghana and West Africa.

"Apiculture Promotion" (TCP/GHA/4505), a project to improve living standards of rural families was implemented in 1986, through beekeeping activities to extend APU training activities. GRATIS was taking care of marketing problems of honey and wax. "Gwira Bansa Project", is a forest-management project, to obtain timber and nontimber forest products, such as honey and wax[16]. There are plans to build honey buying and processing centres[13]. "Ghana Regional Appropriate Technology Industrial Service", GRATIS, is established in 1987, by Ministry of Industries, to establish "Intermediate Technology Transfer Units", ITTU's in all regions. Beekeeping began in 1970's, when TCC introduced Kenya top bar hives. Workshops were held in Kumasi, Accra and in many regional district centres[15].

## 5. Guinea

Beekeeping in Guinea and behaviour of bees from French Guinea imported for the first time to Paris was described[126].

A project from Hive-Aid, was achieved "Integrated Rural Development in Fouta Djallon (Apiculture Component)", GUI/86/004, to evaluate potential for api-culture development in the project area. Consultancy services come from FAO.

## 6. Guinea-Bissau

Guinea-Bissau was going to remain a "green" country, 80% of population work in agriculture. Traditional hives are made from local materials. Beekeeping and honey hunting are practised all over the country, particularly in the Eastern Province, with good natural vegetation. During 1960's and 1970's, many tonnes of wax were exported, however exports have now declined[60]. An improvement is pouring hot water on the combs. Almost of honey is marketed for alcoholic beverage "Cana". Beekeeping has existed for centuries in Gabu[135]. Large number of traditional hives are found in the north-east part. About 3200 beekeepers are living in 674 villages in the region. About 150 tonnes honey/year were obtained in May and June, mainly from traditional hives. High quality honey with moisture content from 16% to 18%, from sealed honey combs, is possible to obtain in May-June. Kenya top bar hives were used in Gabu. A small number of honey hunters collect honey from feral colonies in hollow tree trunks and abandoned termite hills. "Beekeepers Association" of Gabu, began work in 1985, in 19 villages. In 1988, 195 members brought 16600 kg honey combs to the "Honey House" in Gabu.

Beekeeping in overseas provinces was described[2]. *A. m. adansonii*, is a small in size, very productive in honey and wax, aggressive and highly resistant to diseases[37]. A HIVE-AID Project, "Apiculture Development", in 1988, to evaluate potential for beekeeping development in Guinea-Bissau. A "Beekeeping Development Project", funded by FAO, was conducted in Pitche, Eastern Province[60], to set up a honey collecting centre, to establish a demonstration apiary, to introduce traditional bee hive, conduct experiments with modern hives, a "Workshop for Hive Construction and Training". The Government has set up a "National Beekeeping Department", for beekeeping development[37]. There are two methods of honey and wax production, traditional beekeeping and modern beekeeping. Kenya top bar hives, Langstroth hives and modified Dadant hives made of good quality, long lasting and expensive wood, are used. In 1989, there were projects in operation in the north, which financed by NGO's from Canada, Germany and Holland. Number of existing traditional hives is estimated as follows, North, 22352; East, 93464; South, 16446 hives.

1st Seminar for "Beekeeping Development", was held at Bagri and Caborangue, in 1991, and was organised by "Beekeeping Department", Ministry of Rural Development and Agriculture.

## 7. Ivory Coast

Ivory Coast or Cote d'Ivoire, is a West African Country. *A. m. adansonii*, has adapted successfully to tropical climates, e.g. by using subterranean cavities as nests[36]. Plants visited by bees were listed[86].

A project was implemented, SODEPRA, Apiculture Centre, In Katiola Region, in 1991, to improve extension and marketing, with GTZ.

## 8. Liberia

Some difficulties of beekeeping in Liberia, were described[28]. General standard for the labelling of prepackaged foods, applies to honey.

## 9. Mali

A project was applied, "Apicultural Development" (MLI/85/003), to consolidate and organize the CAN, in 1986, of Bamako, which has responsibility for training, technical assistance and research, to prepare and initiate applied research programmes, and to consolidate rural apiculture activities.

Postage stamps showing African honey bees in Mali, are produced in 1988. They can be a useful way of promoting interest in beekeeping.

## 10. Niger

A beekeeping project was underway in Gaya, Niger, to teach beekeepers the skills of beekeeping (as opposed to honey hunting), how to handle and process honey, to teach apiculture to students, who will themselves become teachers. Beekeepers are now interested in starting a beekeeping co-operative to market honey and wax[54]. A project about beekeeping development between Egypt and Niger was conducted.

Traditional hives are treated with special "medicament", which is the secret of every beekeeper. Before placing a log hive in tree, the beekeeper places the hive over a hole in the ground, which contains the

burning "medicament". The smoke is believed to give the hives a "taste", which attracts bees. Traditional hives from grass are also reported for Niger[55].

## 11. Nigeria

During the Middle Ages (1000-1500 AD), Arab travellers in West Africa, which include North Nigeria, recorded the use of honey as food and mead, and referred to the existence of bee hives and honey.

The forest nesting sites of *A. m. adansonii* and *A. m. unicolor*, beekeeping in Nigeria, Ngamo practice of beekeeping in hives of plaited grass, pollen analysis from Southern Nigeria, was studied[81]. Traditional beekeeping in Zaria area, was studied[146]. One man could put about 100 hives in trees, in one season. Plants visited by bees, were listed[59, 103]. Honey processing by a honey press (cheese press), from traditional bee hives was described[104]. The honey combs are harvested after dark or after a full moon and before a new one. A torch, from grass provides smoke. A method of beekeeping management, based on colonies seasonal development, was developed[105]. In Adiani Forest Reserve, Kanuri people are using calabashes in trees as bee hives. Traditional bee hives wood or half or quarter steel drums fitted with wooden top-bars and modern hives at "International Institute of Tropical Apiculture. IITA, Ibadan, in farms at Ayepe, Osun State, in Oyo North, at Ilesa and Dogon Dawa. Press extraction yields the same net weight of honey/crude comb weight, as a centrifuge, which is usually 70-80%. Some bee-keepers in Nigeria are harvesting annually a metric tone of honey or more from traditional hives.

*A. m. adansonii*, may occur at any height to 30 m from ground level. Main pollen sources, *Talinum triangulare*, *Combretum paniculatum*, etc. Tendency to attack of African honey bees, depends on the character of the colony, its strength, the type of nest or hive, season and day time, and temperature. Main honey flow, in Ibadan, occur from July to February, with a peak in January. A spectacular bee flower is *Combretum smeathmannii*. Minor honey flow is April-May. African honey bees collect pollen from maize and oil palm. Dearth season lasts from May to July. Absconding from April to August, and swarming from July to October. In Ayepe, only 50 km South-East of Ibadan, seasons are few weeks later. The main nectar flow, occurs from May to August but the decrease in flow does not result in absconding. In Ilesha, 100 km East of Ibadan, seasons are few weeks later. In Baba Ode (Oyo North), 70 km. North-West of Ibadan, honey from feral colonies is harvested in May. Important trees are: *Vitellaria paradoxa*, *Parkia biglobosa* and *Acacia*. Swarming from April to July, with a June-peak. Honey storage in November-December, at Umudike Imo State, East Nigeria. Cassava and Citrus nectar flow is more important than the forest flow. Stingless bees or Meliponini, occur all over the tropics. In Nigeria, family Apidae contains two tribes, Apini, with only one species and stingless bees (Meliponini, with 9 species). *Meliponula bocandei*, store large amounts of honey. Traditionally, African honey bees are kept in traditional hives. Clay hives are protected by pointed grass roofing. Straw hives, from grass stems, are cylindrical but the woven type tapers at one end. Pots placed on or a little above the ground, are typical of Southern and Central States, but also used in Plateau and Southern Bauchi State, in trees. Unbacked clay or mud hives, weighing 30-50 kg are in Kaduna, Central Nigeria. Gourds, placed in trees, in all Nigeria, in South they have a capacity of 15-50 litres, but in North, Jigawa, may reach 300 litres, in *Tamarindus indica*. Straw hives are used in Northern States, one or two hives are placed in a tree, at height of 10-20 m. Traditional beekeeping in trees, is practised by men, but pots on the ground, in Southern and Central States, are owned and harvested by women. In East, palm wine is used to attract bees to traditional hives. Many types of honey are found from traditional hive, modern hive and honey hunting. Very dark amber "Black African Honey", is valued as medicine in traditional and rural communities, and white or light amber honeys are valued as food stuff or sweetener, in the modern urban society[106, 107, 108].

The Leventis foundation, Nigeria, has taken the initiative to include beekeeping in the curriculum of its agricultural schools in Ilesa (Oyo State) and Dogon Dawa (Kaduna State).

*Eucalyptus camaldulensis* is a major source of nectar and pollen for bees. It flowers all year. Honey is white to light amber, of a mild flavour and fairly quickly granulated[58]. Honey is believed to sharpen the mind, and in teaching Arabic may even be mixed with ink for writing Koranic texts. The "Holly Koran" says of honey "that in it lays the healing of mankind". In Christian fasting, and by Muslims at Ramadan, it is eaten to break the fast[44]. 75% of mediocracy, in Nigeria, is covered by Traditional Medicine and all Traditional Healers use honey in some of their preparations[78]. The harmattan wind has a great influence on honeys collected between December and March in West Africa, causing them to thicken. The coastal areas are less influenced and therefore produce honeys of lower viscosity. Heating temperature to force honey to flow must be not more than 30°C[8].

## 12. Senegal

Senegal is located in the far West of Africa, in the inter-tropical area. For Senegal, plants visited by bees were listed[110]. In Senegal, the year can be divided into 4 seasons. During rainy season, end of June, there is no beekeeping. Swarming occurs from October to December, January the time to hang up traditional hives in trees. The dry season, takes place from end of October, to July in the north, and from December to May, in the south. The driest months, are March and April. In south, honey harvesting in May and June. Nine climatic and beekeeping regions are found in Senegal. Best beekeeping in Lower, Upper, Casamance and

Kedougou. Aggressivity of *A. m. adansonii* is more among wild colonies, than those kept in modern hives. Selecting the most gentle strains is needed. Traditional hives used are: Cylindrical hollowed log, used horizontally; conical hollowed log used horizontally; conical skep, woven from straw (Thiadiang) suspended vertically, cylindrical woven hive, used horizontally; conical skep, suspended horizontally. Modern hives adopted in Senegal, is of Langstroth type, with modifications. Hard, termite and decay resistant wood of *Cordyla pinnata*, is used. Mahogany, is also used. "Beekeeping Section", Dakar, supervises 7 "Regional Beekeeping Stations", set up in the most favourable beekeeping zones. 310 tonnes honey and 30 tonnes wax, mainly from traditional hives, were obtained. Mean yield from modern hives is 15-20 kg honey/colony[110].

The production and commercialization of beekeeping products, Basari in East, "Improved Greek Hive", "Rinka Hive", beekeeping methods, bee plants and the future of the industry, were discussed[83]. The main tribes interested in beekeeping are: Halpoulaar, Diola, Mandingue, Basari and Wolof. Honey producing regions are: Casamance, Senegal, Sine-Saloum, Rio and Cabo Verde. Government implemented "Developing Beekeeping Programme". Between 1987 and 1995, efforts were made, to modernize and develop honeys and wax production[63]. In Senegal, the number of hives/beekeeper, varies depending on climate. In the south, with Sudano-Guinean climate, the number is greater, 15 or more, with mean yield of 20 kg honey/hive. That output is due to productive *A. m. adansonii*. In Senegal demand is greater than production[140]. Four types of hives are used: traditional hives, hives imported from Europe, "Improved traditional hives", e.g. Kenya top bar hive and an appropriate hive design from West Africa and the modern local hive, the "Vautier Hive". From modern hives, 20-25 kg honey can harvested, while from traditional hives, only 3-8 kg/hive, can obtained.

Project of "Rural Development", in Basse Casamance Region; Senegalese Association for Promoting Small Projects of Economic Development; GONAKIER Project, of Saint Louis; Rural Forest Exploitation Project of DABO-KOLDA; Society of exploiting the Animal Resources in Senegal, for honey marketing. NGO's, French Association of the Progress Volunteers; Centre for International Relations for the Development in Beekeeping; ARRADON Association "Tiers Monde", PROWALO Organization; Producer Associations: Federation of the Agro-Shepherds of the Fouladou region; FECAPS Association, ASSOLUCER Association, AGDER Association, National Initiative Committee for Promoting Beekeeping in Senegal. Centres of Beekeeping are: The Centre at Guerina, Centre at Kolda, Centre at Toubacouta and at Dakar. All the previously mentioned projects, association and centres are working to promote beekeeping.

### 13. Sierra-Leone

In Sierra-Leone, a green papaya beeswax mould was invented. A hollowed-out green papaya is used. Pour clean, molten bees wax into the mould and rest in a cool place for a few hours until the wax has set hard[3]. The bamboo candle moulds was prepared[136]. A section of bamboo with inner diameter about 20 mm was used.

### 14. Togo

Plants visited by bees were listed[148]. Most people are employed in Agriculture. Main crops include, cocoa, coffee, copra, cotton, maize and groundnuts. Traditionally, honey is used in ceremonies and medicines. Clay hives are used. Modern hives is practised, mostly central and Southern regions. Swarming occurs from September to December. Lack of working materials in the local market is a serious handicap to the promotion of beekeeping. 73 bee plants were identified during a study. Major sources in Northern and Central Togo: *Azadirachta indica*, *Parkia biglobosa*, *Vitellaria paradoxa*; In South, *Cocos nucifera*, *Eucalyptus torrelliana*, *Mangifera indica*, *Citrus*, *Acacia*. Period of harvest lasts from December to April. In January 1992, a Centre was created at the University of Benin in Lome to promote research. This centre studies the ecoethology of bees in different regions of Togo[128].

### Conclusion

In Africa, development of apiculture technologies is needed to enhance the income generation potential of small holders. These technologies promote the conservation and utilization of natural resources that are rapidly being depleted. Vandalism has been responsible for the destruction of the more tractable strains of bees and the consequent survival of the fiercest strains. In old days the honey production was a major industry in the economy of African life. Honey was a vital factor in African culture and was used in many ways as an article of trade. In Africa, where a rich nectar flow is found, relatively small quantities of honey are produced by African honey bees.

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