

Apiculture (Beekeeping), an Easy Economic Venture Irrespective of Age, Gender, Religion and Profession

Kubkomawa Hayatu Ibrahim^{1,*}, Mohammed Abubakar Sadiq Abba¹,
Kenneth-Chukwu Oluchi Margret², Iyiola Vivian Ogechi³, Anyanwu Vivian Chinenye⁴

¹Department of Fisheries Technology, Federal Polytechnic, Mubi, Nigeria

²Department of Veterinary Biochemistry and Animal Production, College of Veterinary Medicine, Micheal Okpara University of Agriculture, Umudike, Nigeria

³Department of Animal Production and Health, Federal University, Wukari, Nigeria

⁴Department of Animal Science and Technology, Federal University of Technology, Owerri, Nigeria

Email address:

kubkomawa@yahoo.com (K. H. Ibrahim)

*Corresponding author

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Abstract: Apiculture is an agroforestry system that has been neglected at the background in tropical Africa and Nigeria in particular. This is due to lack of awareness on the production know-how and the financial gains associated to it. The objective of this paper therefore, is to review apicultural techniques and its economic benefits. Apiculture is one of the most booming lucrative enterprises in many parts of the world. It is a profitable venture that requires little or no investment with quick returns. It is the science of raising bees in order to harvest honey and other useful products such as propolis, beeswax, pollen and royal jelly (bee milk). Honey and wax are usually used as medicine, health food and traditional crafts (candle making). In the traditional setting, honey is usually harvested from the wild which is always crude, difficult, dangerous and unsustainable. There is high demand for honey in Africa and the world at large but the production is low and not being encouraged. However, apiculture has gradually become a major component of mini-livestock production in Africa and other parts of the world. It has relatively reduced honey hunting and is seen as an alternative business for employment and revenue generation. Beekeeping can be practiced by all irrespective of age, gender, religion and profession with no negative environmental impact. Government and well to do individuals in the society should assist interested beekeepers with soft loans to purchase modern equipment like movable frame hives, bee suits, smokers and honey extractors. Apiculture should be enshrined in the curriculum of the primary and secondary schools, institution of higher learning and adopted as part of rural development approach. It should be promoted by well-organized extension services. Improving beekeeping in Africa will be a good way to ensure food security, reduce joblessness and add income across the economies of the continent. Efforts should also be made by Export Commissions to showcase African honey in the world market.

Keywords: Apiculture, Easy Alternative Income, Tropical Africa

1. Introduction

Bees are social insects which live together in large organized, sophisticated groups and communities called colonies. Furthermore, a colony may have up to 100,000 bees divided into three main groups called castes [6]. Studies have shown that, there about 20, 000 species of honey bees in the

world with only two domesticated and used in beekeeping business [10]. These species are *Apis cerena* and *Apis mellifera* found in South Eastern Asia and worldwide respectively [11].

Bees are considered the smallest of all min-livestock in the world. They are naturally attracted to flowers which allow them to feed on the sweet substance (nectar) to produce

honey and other several products [8, 10]. Apiculture is the science of breeding, rearing and management of honeybee colonies in artificial hives for economic gains [6, 10]. The technical know-how can be acquired, learnt and practiced either as a hobby, part or full time trade or occupation. These social insects thrive well in natural environments such as undisturbed forests, ant hills, rodent holes, caves and on integrated farms with an abundant supply of water and flowering plants [3].

Apiculture provides unexploited revenue capable of taking people out of abject poverty and hunger [1, 8]. Similarly, beekeeping enterprise if properly handled could aid in reducing the high rate of poverty especially in the rural settings and boost African export base [2, 8, 14]. In addition, it can provide useful products, source of income, empowerment of youth and women and pollination of crops in tropical countries [2, 9, 7, 4].

It has been reported that, Africa consumes more than three times the amount of honey it produces [6]. Aside Ethiopia, Kenya, New Guinea, Papua and Tanzania who are self-sufficient in honey production and also produce most of the continent's honey, other large markets like Nigeria and South Africa are deficient in bee products [6, 8].

In other continents, research has shown that, Thailand has increased production from zero to more than 1,000 tons yearly. Likewise in Brazil, beekeeping has become more popular and doubled before the emergent of the African honey bee [5]. Honey is the most preferred natural sweetener in the world and global trade in bee products is worth millions of dollars every year [2, 6, 10]. Because of its diverse uses, the world consumption of honey is so huge that its supply could not match its demands [6].

Furthermore, studies have shown that, almost all villages in tropical countries of the world have had traditional beekeepers [5]. Most of them use local traditional pots, thatched or grass hives that lead to low yields and waste. Today, many modern methods and equipment are used [6]. Though many of them are still not widely known and their relevance is slowly being recognized. Bees are the least in demand of space and the most easily adapted to worldwide rural development efforts [12]. However, they are relegated to the background in agricultural programs in Africa and Nigeria in particular [10]. The objective of this paper therefore, is to review beekeeping techniques and its associated economic benefits.

2. Appearance, Size and Distribution

Honey bees are easily recognized through their small oval sizes, colourful shining bodies and the noise they make especially in hives, search of nectar and relocating. The major species and subspecies are slightly similar in appearance and size [5]. Amongst the species of bees that produce honey and pollen in harvestable quantity, only two (*Apis cerana* and *Apis mellifera*) produce multiple combs and can be kept in hives [6, 10]. Similarly, with good forage and management, they can produce enough honey that can be

harvested without destroying their colonies. *Apis mellifera* is the most widely distributed and exploited honey bee which originated from Europe and Africa [12].

The subspecies *A. mellifera ligustica* is mostly preferred because it's docile and highly prolific. It is currently the most predominant honey bee in the temperate zones of Europe, North America, Australasia and China. *A. mellifera adansonii* and *A. mellifera scutellata* are the common native subspecies in Africa [6, 10]. *A. cerana* is the docile bees found in Asia (Middle East to Japan and Southern Indonesia). It produces less honey per hive than *A. mellifera*, but its overall production in many South-Eastern Asian countries may be greater [5].

3. Status, Habitat and Environment

Honey bees are not under threat of extinction of any kind. But however, the genetic diversity is disappearing due to loss of habitat through the use of insecticides, mass production of genetically uniform queens and exotic breeds, destructive harvesting, spread of diseases and pests [5, 10]. Honey bees can exist and survive in many locations from deserts to rainforests and near the Arctic to the tropics. They usually occur and thrive better in areas with abundance of nectar, pollen, trees and water [12]. Excessive heat or ambient temperatures, especially during the months of March and April with scorching sun in the tropics, drought, heavy rain and high humidity may disrupt or halt their activities, making them seek for shelter. But a well-managed colony can survive periods of extreme adversity [5].

4. Reproduction and Behavior

Honey bees appear to live in rigidly hierarchical colonies normally with a single queen [5]. After a successful mating, the queen begins to lay hundreds of eggs a day. Those that are fertilized become sterile females, called workers; those that remain unfertilized develop into males (drones), whose only role is to fertilize future queens [12, 10]. After a period of two to three years, the queen gets worn-out and lays fewer eggs and the colony may replace her with the new active queen [6]. At that space of time, few female larvae are raised on royal jelly, milk like nutritious secretion that causes them to develop into queens [5].

The workers perform different duties as they mature and young ones attend to the queen, guard the hive, and raise the larvae [6, 10]. The older ones (majority of a colony's population) gather pollen, nectar and water [6]. Pollen provides the protein, fats and the nectar converted into honey in the body of bees which also provides carbohydrates to feed the colony [12]. The activities of honey bees are dictated by weather, availability of food, genetics and the overall strength of the colony [5]. They are mediated by chemical interactions between the queen and the workers that control almost all behavior.

The Asian and European bees are relatively docile, but most of the African subspecies are unpredictable and may

defend their colonies in great numbers, full force and with great persistence [6]. The threat of killer bees has been greatly exaggerated, though spiritualized in Africa [12]. It is however, speculated that, wearing a perfume may attract the fiercest wrath of killer bees.

Occasionally, large numbers of the bees in a colony split off from their nest or hive. They usually cluster on a nearby tree or building, calmly waiting for scouts to find a suitable new home as can be seen in Figure 1 [6]. These homeless swarms can be captured and will readily move into a hive which is the simplest and cheapest way for beekeepers to acquire a colony [5].



Figure 1. Bee Swarms (Source: *beekeepinginnigeria.blogspot*).

5. Bee Husbandry

Beekeeping involves management of a colony to produce enough honey or wax [5, 10, 15]. The major production is achieved by the bees themselves (Figure 2). The insects can produce their own food all year round, while man only does the harvesting and processing. However, it requires provision of good hives; obtaining bees by collecting a swarm, transferring a wild colony using a perfume or animal fats to attract them into a hive or purchasing a complete colony with an active queen [12, 15]. This also follows by protecting and maintaining of colony from natural enemies that enhances high honey production [6, 15]. The ability and technical know-how of a farmer to harvest enough honey without weakening or destroying the colony is an adage advantage [5].

For better output, hives are placed beside the steady source of water and in shades of green trees to reduce the excessive hot weather. Painting of the hives in white colour is required to reflect sunlight rather than absorb heat ([12, 10]. This is helps to avoid the effect of albedo by keeping the hives cool. Hives should not be placed near crops sprayed with herbicides and pesticides [6]. Hives are adequately protected from strong winds by supporting them with robes and tree branches. Hives are placed far from residential areas to avoid people being stung by bees. Hives are not placed where water is dropping directly from tree branches onto them [5].



Figure 2. Honey Production (Source: *guardian.ng*).

6. Harvesting of Honey

Bees take some time to produce honey in harvestable volume or quantity [5]. This also depends on the number of bees in a colony, all the necessary production conditions such as availability of water, flowers and nectars [12, 10]. In an ideal situation, honey takes ten to twelve months to mature before harvesting [5, 6]. Subsequently, if the colony is fully established, one can harvest between seven to eight months as shown in Figure 3.



Figure 3. Harvesting of Honey (Source: *nigerianinfopedia.com.ng*).

Honey is usually harvested at the end of flowering seasons especially around April, May and June in tropical Africa [5]. Harvesting proceeds by picking the extreme combs that contain ripe honey with an envelope of thin layer of bees wax [6]. While harvesting, combs containing pollen or developing bees are left in the hive. Honey is separated from the beeswax immediately after harvesting [10]. The honey is sieved and packaged while beeswax processed into a block and store until enough to sell [6]. To ensure quality, honey should not be adulterated by feeding them on sugarcane, but on pure nectar and pollen [12]. Food additives should not be added to honey after harvesting, it shouldn't have flavours, ferments or foams [5].

7. Beekeeping Equipment

Hives: These are essential containers provided by man for bees to nest in [5]. They can be made out of tree bark or wood and other equipment such as woven grasses or stalks, clay pots gourds, wall, log and calabashes [12, 6]. They can be grouped into traditional, intermediate and high technology movable frame hives (top-bar hives, langstroth and dadant).

7.1. Top-Bar-Hive

This is one of the most used in third world countries as shown in Figure 4. This crate-like box that incorporates

modern beekeeping principles also adds the innovation of sloping sides [12]. Beneath its lid are removable boards (top bars) from which the bees hang the combs. Since the sides are sloping, the bees do not attach the edges of the comb to them [10]. Through lifting of the top bar, the comb can be inspected and the honey harvested with little disturbance to the colony [6]. This simple hive can make beekeeping accessible to even the poorest people. It is easy to build and use, and can be locally constructed from scrap lumber. It is well suited for raising most types of honey bees [5].



Figure 4. Top-Bar Hive (Source: agroaf.com.ng).

7.2. African Long Hive

This is one of the more elaborate and productive in Africa [5, 12]. In addition to having top bars, this square-sided box has removable frames within which the bees build their comb (Figure 5).



Figure 5. African Long Hive (Source: www.alamy.com).

7.3. Langstroth Hive

This is also the most elaborate, the type most common in temperate zones (Figure 6). This yields high quantity of honey [12]. It can be made only where there are good durable available facilities with better extension services to aid and assist beekeepers [5].



Figure 6. Langstroth Hive (Source: En.wikipedia.com).

7.4. Traditional Langstroth Hive

Traditional Langstroth hive is simplified designs which is built and maintained for use in developing countries (Figures 7 and 8). Hive is the single most important piece of equipment needed in beekeeping because it allows proper handling of the bee colony and determine the volume of honey that will be harvested [5, 12].



Figure 7. Traditional Langstroth Hive (Source: jaguzafarm.com).



Figure 8. Traditional Langstroth Hive (Source: thisisafrica.me).

Bee Suits: These are the overall protective clothes comprising of face cover/veil or hat, hand gloves and boot (Figures 9 and 10). It is usually worn when approaching the bee hives to check or harvest the honey [12, 10]. These provide maximum protection to the farmer from the sting of the bees [5].



Figure 9. Bee Suits (Source: www.pinterest.com).



Figure 10. Bee Suits (Source: backyardbeekeeping101.com).

Smokers: They are modern and traditional equipment used to scare away bees while harvesting the honey (Figures 11 and 12). Traditionally, hot flames on burning bunch of grasses or stalks are used during the day time or at night to chase or kill the bees to allow for easy collection of honey [5, 12].



Figure 11. Modern Smokers (Source: www.alamy.com).



Figure 12. Traditional Smokers (Source: www.alamy.com).

Honey Extractors: These are modern equipment that look like bucket incorporated with sieve to squeeze out honey from the comb (Figures 13 and 14). The tools assist the farmer especially when the honey is plenty since ordinary hand cannot be used [12, 10]. Traditionally, bare hand is used in harvesting honey and is sold un-extracted [5].



Figure 13. Electric Extractor (Source: www.made-in-china.com).



Figure 14. Manual Extractor (Source: www.amazon.com).

7.5. Other Materials or Tools

Other necessary tools that formed part of the beekeeping equipment are cutlass or small knife, buckets (basins), wheelbarrows, plastic containers, funnel/ sieves, packaging machine, weighing scales, nylons for packaging, sealing machine, storage bottles, brush and stand-by generator as shown in Figures 15 and 16 [5, 12, 10].



Figure 15. Beekeeping Tools (Source: www.amazon.com).



Figure 16. Beekeeping Tools (Source: www.hobbyfarms.com).

8. Economic Benefits

Honey: It is a sticky, juicy and sweet- tasting substance produced from the nectar or secretion of flowers by bees as shown in Figure 17 [12]. It is popular for its taste and flavour which contains carbohydrates (80-85%), water (15-17%), protein (0.3%), ashes (0.2%), amino-acids and vitamins [5, 12, 13]. Because of its natural sweetness and chemical properties, it is preferred over synthetic sugar and other conventional sweeteners used in baking, beverages and foods [5, 6].



Figure 17. Raw and Original Honey (Source: www.jessicagavin.com).

Honey is used as a sweetener in food, alternative to sugar,

nutritional supplement for children, athletes and people suffering from diabetes [12, 6]. It is rich in carbohydrate, minerals and vitamins that keep human body mentally sound and physically strong. Honey, when in the comb is pure and clean. If harvested carefully, needs no further processing [12, 10]. It is a complement of traditional and orthodox medicines for treatment of various ailments such as sore throat, cough, hay fever, prostate cancers, burns, wounds, stomach problems like ulcers and generally, reduces the risk of contracting COVID-19. Honey is used in the pharmaceutical industries as a sweetening agent for children's drugs [5].

Apart from its flavor, it retains moisture better than sugar or syrup and therefore prolongs the shelf life of products [12]. Honey-based alcoholic beverages are popular in many parts of the world. It serves as raw materials for production of commodities in brewery and cosmetic industries such as cleansers, lotions, body creams, lip balm, and other confectionaries like mice and rat repellents [5, 10]. It is also incorporated into animal feed to enhance milk production in dairy cows [5].

Bee Wax: Craftsmen and manufacturers still spend a lot of money importing beeswax which can be produced locally [12]. Beeswax has much wider use than honey especially in food processing industries as additive and common ingredients in chewing gums as can be seen in Figures 18 and 19 [12, 6].



Figure 18. Raw Bee Wax (Source: www.pinterest.com).



Figure 19. Processed Bee Wax (Source: www.alibaba.com).

It is used for the manufacturing of cosmetics (soaps, skin care, lipsticks, lip balms, eye shadows, blush, hand creams, moisturizers), candles, lubricants, foundation sheet (for houses), shoe polishes, adhesives and textile [5, 10]. It is also good for making temporarily tooth filler (dental work), water

proof agent for wood and leather, electronics (for lost-wax metal-casting and sculptures) as well as batik-dyed clothing [5, 6]. Most beekeepers are unaware of bee wax economic benefits and often discard it after harvesting honey from bee's hives. Bee wax has over 100 industrial uses and is widely known to have a ready market both at home and abroad [12].

Propolis: It is also known as bee glue, sticky substance collected from leaves, buds and sap of certain trees [12, 6]. Bees use this to fill cracks in their hives, to seal the entrance when it is too large and to keep the hives clean and free from diseases and parasites (Figures 20 and 21).



Figure 20. Raw Propolis (Source: www.mindbodygreen.com).



Figure 21. Processed Propolis (Source: draxe.com).

It has some therapeutic and antibiotic usage [12]. It is used to prepare cough syrups, toothpastes, lotions, skin soaps and skin oils. It possesses several properties that make it very suitable as an antibiotic and antifungal agent in the pharmaceutical industry [12, 6, 10]. It is also used in natural medicine to treat various conditions, including inflammations, viral diseases, ulcers, skin burns and scalds [5].

Pollen: It is a powder-like material found on flowering plants that is collected, eaten and stored by bees in honey comb cells as shown in Figures 22 and 23 [12, 6]. It is basically food for bees. In many developed countries, pollen is used in some expensive dietary supplements, since it is believed to have valuable medicinal properties. It is used for making perfumes and cosmetics [5].



Figure 22. Raw Pollen (Source: www.earth.com).



Figure 23. Processed Pollen (Source: glorybee.com).

Bee Venom: It is scientifically known as apitoxin and used by the bees as a defensive weapon to protect the colony from intruders and attackers (Figure 24). This substance is responsible for the bee's painful sting and is produced in the abdomen of worker bees that defend the bee colony. Bee venom is used in medicine for the treatment of rheumatism, eye and skin diseases and other joint diseases due to its anti-inflammatory actions [12, 6]. It is also used to desensitize people who are allergic to bee stings and insect bites [5].



Figure 24. Bee Venom (Source: www.empr.com).

Royal Jelly or Bee Milk: It is a special substance produced by worker bees and fed to the queen bees (Figure 25 and 26). It is a good source of vitamin B. Like pollen, it is thought to be medicinal in nature and is used in certain expensive dietary preparations [12, 10]. It is used to cure infertility and dressing wounds and consumed more in Asia than any other part of the world. Consumption of royal jelly in China alone is over 75 tonnes annually [6]. It is used for chocolate candy and wines, as well as lotions and tonnes for natural healing. Bee larvae are eaten raw or fried in many parts of Asia and Africa and are considered a delicacy [5].



Figure 25. Raw Royal Jelly (Source: www.amentsoc.org).



Figure 26. Processed Royal Jelly (Source: www.bee-pollen-buzz.com).

9. Conclusion and Recommendations

Beekeeping is one of the most respected businesses in many parts of the world that provides direct food for many people, crop yields through pollination, medicine, industrial raw materials and income. It requires little or no capital while promoting self-reliance and ensuring food security. It is an easy going economic industry that can be set-up with minimal equipment and training irrespective of age, gender, religion and profession. Most of the honeys consumed in Mubi are either imported from Cameroon Republic or brought from Ganye, Gembu, North Central and Southern Nigeria.

There are no profits without losses as bees are susceptible to various predators, pests and diseases. Once a colony becomes infested it may have to be destroyed. Hives or combs full of honey are targets of thieves and may be stolen. There also cases of swarming and absconding, some or all of the bees may leave a hive and start a new nest, taking even the honey with them.

There's a lot of adulteration of honey, it's really hard to find raw original honey nowadays. People adulterate honey with different things such as water, sugar syrup, or corn syrup. Though, the viscosity, colour, or even a fire test of honey is dependent on the environment. For example, honey from northern Nigeria is thicker due to the dry weather and open hives. The nectar is also different from what bees would get in the southwest. The only way to test the rawness or originality of honey is by conducting a scientific test.

Government and well to do individuals should assist interested beekeepers with soft loans to acquire modern equipment such as movable frame hives, bee suits, smokers and honey extractors. Beekeeping practice should be adopted and enshrined into curriculum and syllabus of the secondary and tertiary intuitions in African sub-region. It should be adopted as integrated rural development approach and should be promoted by a well-organized extension services. Improvement in honey production is a sure way of adding market value to apiculture business and efforts should be made by Export Commissions to show case African honey in the world market.

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