

The status of beekeeping practices and honey production system in Ethiopia-a review

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Abstract - In Ethiopia beekeeping has started in ancient time and gifted various bee races and also adapted to different agro-ecological zones except desert part of Ethiopia. The objective of this review is reviewing practices of beekeeping, types of beehive and honey production system in Ethiopia. The purpose of Beekeeping practices is mainly for honey and wax production and as source of foreign currency to Ethiopian communities. Honey production system is mainly classified in to traditional, intermediate and modern. A small quantity of honey is consumed by Ethiopians as tej which is very popular in Ethiopia. Practice of beekeeping is hindmost in traditional materials and traditional management system. Main factor for production of honey is based on sustainability of honey bees in hives due to difference in their race and construction of their nests. Honeybee plays a significant role in the economy of Ethiopia through pollination services that affect seed production in agricultural crops. A good beekeeping area is the one in which nectar and pollen plants grow abundantly and with a relatively long blooming season therefore Ethiopia is among the most potential of honey bee flora but their source is differ from plant to plant. Honey production constraint also extends in socio-economic conditions, cultural practices, climate and behaviors of the bees. These create deforestation, soil erosion and irreversible ecological degradation. Quality standard of Ethiopian honey is low as a result of many poor post-harvest treatments like; poor containers, storing room conditions, and many other ingredients mixed in are among some to mention. Ethiopian bee keepers required massive training how to harvest, handle, transport and storing of honey and other hive products.

Keywords - beekeeping, traditional, hives, honey and beeswax

I. INTRODUCTION

The practice of bee keeping is as old as any other agricultural practice in Ethiopia. It has been an alternative source of income to farmers especially in rural communities [6]. Honey is traditionally consumed by Ethiopians in small quantities, and most honey is diluted with water, mixed with herbs and fermented in big pots. So-called tej is a very popular honey drink in Ethiopia, and is consumed by people across the country [18]. There are about 10 million bee colonies and over 800 identified honey source plants in Ethiopia. Although small holder farmers use traditional bee hives, the annual honey and bee wax production are estimated at 24,700 tons and 3,200 tons, respectively, of which more than 90 percent of honey produced is used in the country for domestic consumption. Ethiopia is the first honey producing country in Africa, and the fourth bee wax producing country in the world after China, Mexico and Turkey [22].

Traditional bee hives are made from local materials such as hollowed-out logs; bark formed into a cylinder, clay pots, and bamboo grass or cane whatever is suitable and available[7]. According to the [18] traditional hives are relatively easy and inexpensive to make and can use local materials and traditional knowledge for making them. Bees often prefer these hives to more than 'modern frame hives. Traditional hives are for bee management is difficult they can be difficult to harvest and the yields and quality of honey can be lower than top bar and frame hives. No possibility to inspect comb for brood. No selection for honey yield and multiplications. High chance the colony (queen) is killed during harvesting and very difficult to judge the maturity and ripeness of honey before harvesting.

According to the [7] the cheapest and most durable of all the traditional hives is the clay pot, very popular especially in the northern savannah of West Africa. The pot is similar to the type generally used to carry water or other liquids, modified to provide a wider mouth and a small mid-section hole for both exit and entry. The pots, usually made by the elderly women, are bisque-fired, and the inner part is smoked as part of the baiting. They are then baited with cow dung or other waste and installed on the ground or on pegs in trees. In some areas, the pots are turned upside down directly on the ground, for beekeepers find that when they are installed on a flat plate or wood, bees glue the plate firmly to the hive with propolis, making harvesting tedious. This method of installation, however, has a serious drawback: frequent ant invasions force some bee colonies to abscond. The Kenyan Top Bar (KTB) hives was developed, as its name implies, in Kenya by Patterson in the 1970's – over 100 years after Lang troth started constructing bee hives with bee spaces and moveable combs [7] Despite of high demand of honey and hive products, numerous colonies in our country and increase population in the country; updated information on the level of honey production and other hive products is scanty. So, this paper is aimed to summarize the existing beekeeping practices, types of beehives and honey production in Ethiopia and which can addresses baseline information to Ethiopian beekeepers and policy developers.

II. STATUS OF BEEKEEPING PRACTICES IN ETHIOPIA

2.1. Honey bees and their distributions

The most important and available insect in the world today is the honeybee. There are several species of honeybees existing, but *Apis mellifera* is famous in our country. It is a wonderful and popular bee type for its honey and bee wax production besides the major value obtained because of plant pollination [3]. Ethiopia has a potential in beekeeping as the climate allows growing of different vegetation and crops, which are a good source of nectar and pollen for honeybees. Large and diverse botanical resources combined with suitable climatic conditions make it conducive for the beekeeping business [29].

According to [19] in Ethiopia, beekeeping has been a tradition since long before other farming systems. Even though it is one of the important and the oldest farming activities in the country, there are no available records, which confirm when and where beekeeping was first started. However, the Hieroglyphs of ancient Egypt refer to Abyssinia (ancient name of Ethiopia), as source of honey and beeswax and Abyssinia has been known for its beeswax export to Egypt for centuries when other items were not exported. It is, thus, assumed that the keeping of bees in baskets may have started about 5000 years ago in the northern regions along with the early settlements. No countries in the world may have ancient beekeeping as Ethiopia [16], [20]. Moreover, the oldest basket hive in the International bee museum is from Ethiopia. At the time of King Ezana, around the 3rd century AD, wax was needed for religious ceremonies and honey for nobility and the social select for making traditional beverages. Despite its long history, beekeeping in Ethiopia is still an undeveloped sector of agriculture. The knowledge and skill of honey production and honey and beeswax extraction of Ethiopian farmers is still very traditional [27]. The geographical features of the country consist of wet highland, highland, mid highland, arid and semi-arid and a small portion of desert. In this geographical diversity, the honeybees have been well distributed and adapted to the condition except for the desert zone of the Afar and Somali regions. According to [9] the overall honeybee colonies present in Ethiopia were estimated to be 10 to 12 million of which 4.8 million are hived.

2.2. Types of Bee Hives in Ethiopia

As stated by the Ministry of Agriculture, there are three types of beehives in Ethiopia, and these are traditional, intermediate, and modern. The survey result of [10] revealed that a total of about 5.0 million hives is estimated to be found in the rural sedentary areas of the country. From this total hives, the greater part (95.57 %) is reported to be traditional and the rest 1.63% and 2.8% were reported to be intermediate and modern bee hives respectively.

The main factor for production of the honey is the suitability of hive for the honey bees. Honey bees differ in their race and constructing of their nest worldwide. In natural conditions, the honey bees build a nest in different places as piles of stones, hollow trees holes on the ground and others, trying to protect themselves against wind, rain, fire, and natural enemies. People built different types of hive for centuries. There are many types of bee hives found in Ethiopia. These hives are categorized mainly as traditional, modern and intermediate (Kenya top bar) hive.

Traditional hives are made up of different materials like clay, cow dung and ash, a hollowed-out log, and thick bamboo stem. The second type of hive is European box hive, Lang troth. Which build by Lang troth in 1852 and that had taken advantages of the other models in some European countries [5]. In our country this langstroth modern hives are widely distributed to the farmers in last decade, but there are a lot of problems with hive in our case, our bee race and their ecological adaptation are different from European bees. The other problem with this hive is its cost that is high at the beginning of the bee's management. Its maintenance cost is also high at operation. This modern hive is made up of pinewood. Wood for building the hives is not available in the market. It comes from abroad or it comes from illegal source which causes environmental degradation [18]. Kenya Top Bar Hives are simple in design and can be constructed for free using locally available materials. Construction plants for KTB hive from local timber and bamboo are available and published by Ethiopian bee scientists. True to their name, KTB hive's need only properly spaced bars on the top; even twigs will do. Bees start building combs from these top bars down to the bottom of the hive, and due to the slanted walls of the outer hive box, will not attach comb to the side. The result is a hive that allows combs to be easy removed and completely inspected [18].

2.3. Honey bee flora plants and foraging intensity

Over 500 honey plants both indigenous and exotic origin has been describe and illustrate as a bee flora in a number of books. All herbaceous, bushes, shrubs, and tree were categorized accordingly. Local name, English and scientific naming for each and the family naming were properly identified beside the use of each plant for foraging bees [16]. Ethiopia is endowed with various climatic conditions; topography and a wide range of altitude favoring the presence of different natural vegetation's that include forests, bushes, herbs, weeds and undergrowth. The flowering plants known in Ethiopia are between 6 and 7 thousand species [13]. The presence of this natural vegetation made the country the best home for honeybees. The forests and woodlands contain diverse species that provide surplus nectar and pollen to foraging bees [4]. Beekeeping has been and still is widely spread, economically important and integral part of the life of the farming communities of Ethiopia [16]. Not all plant species are however equally good for beekeeping. Some supply both nectar and pollen abundantly when in the flower and others still provides nectar or pollens for their brood rearing [17].

Ideally, a good beekeeping area is the one in which nectar and pollen plants grow abundantly and with a relatively long blooming season. Such areas are however not always available or easy to find. Beekeepers must know the time and duration of the blooming season of every major honey plant including the environmental factors affecting them and carrying capacity of the area, which includes the number of colonies that can be put for maximum production [30]. Production of honey and other products depend on availability of floral resources (bee forage) and is a very important field for most beekeepers in the world [31]. There are an estimated 10 million bee colonies out of which farmers keep about seven million in traditional and wooden frame hives, that the remaining exists in forests and services [10] and this represents the highest bee density in Africa

III. TYPES OF BEEKEEPING SYSTEMS IN ETHIOPIA

2.4. Traditional System of Beekeeping

Honey hunting and beekeeping have been practiced in the country for the exploitation of honey. In places where wild colonies of bees living in hollow trees and caves are found, honey hunting is still a common practice in Ethiopia. Currently, in the country bee husbandry has been exercised. In Ethiopia, traditional beekeeping is the oldest and the richest practice, which has been carried out by the people for thousands of years. Several million bee colonies are managed with the same old traditional beekeeping methods in almost all parts of the country [26] and [16]. According to the [29], traditional beekeeping is of two types: forest beekeeping and backyard beekeeping. In some places, especially in the western and southern parts of the country, forest beekeeping by hanging a number of traditional hives on trees is widely practiced. In other most parts of the country backyard beekeeping with relatively better management are common, traditional beekeeping is mostly practiced with different types of traditional hives. The most universal type of traditional hives, known to have been in use is simple cylindrical type. Beekeeping started with traditional or fixed comb hives, so called because the combs are attached to the top and sides of the hive itself and the beekeeper cannot easily remove and replace them.

In its primitive form, only one end of the hive could be open, but in more advanced forms each end of the cylinder will be fitted with a removable closure. The types of hives and the way of keeping bees vary from area to area. Based on locally available materials used for construction of hives, environmental conditions and positions used to keep bees, the following variants of basic design are found throughout the country: hollowed logs, bark hive, bamboo or reed grass hive, clay hive, animal dung (mixed with ash) hive, woven straw hive, gourd hive, earthen pot hive and so on. The beekeepers that are experienced and skillful in using these hives could do many operations with less facility [11]. According to the [20] stated that under Ethiopian farmers' management condition, the average amount of crude honey produced from traditional hive is estimated to be 5 kg / hive / year. On the other hand, based on the survey conducted in West Showa Zone [11], the amount of honey harvested, from a traditional hive on average was reported to be 6.1 kg/hive/year. [18] Also stated that honey productivity from traditional hives is very low, with an average of 5-6 kg per year. Traditional husbandry is practiced with many millions of fixed comb hives particularly in the remote areas of the country. For the period until modern frame-hives are introduced, these fixed comb hives can yield a modest amount of honey, and also about 8-10% of its weight is beeswax. This harvest is achieved with minimal cost and labor, and it is valuable to people living a marginal existence.

2.5. Intermediate system of beekeeping

Transitional/intermediate/ beekeeping started in Ethiopia since 1976 and the types of hives used are: Kenya top-bar hive, Tanzania top-bar hive and Mud- block hives. Among these, KTB is widely known and commonly used in many parts of the country [23]. According to the [1] and [25] suggested that for technical and economic reasons, most African countries are not yet in the position to use movable- frame hives, and for them top- bar hive represents a satisfactory compromise. Although movable frame hives are recommended for experienced beekeepers that want to optimize honey production, the Kenya top-bar (KTB) hive has been proved to be most suitable because of its low cost and the fact that the beekeepers or local carpenters can easily construct it. Top-bar hive in an ideal condition can yield about 50 kg of honey per year, but under Ethiopian condition, the average amount of crude honey produced would be 7-8 kg/hive/year [20]. However, from North Wollo it has been reported that production of 24-26 kilograms crude honey per hive per year [32], and about 8 percent as much beeswax per kilogram of honey is likely to be obtained.

2.6. Modern System of Beekeeping

Modern beekeeping methods aim to obtain the maximum honey crop, season after season, without harming bees [6]. This is the most intensive system, which needs comparatively expensive inputs and relatively skilled manpower to manage the colonies successfully. The hives can generate greater quantities of better quality honey, which will command higher prices [16]. The amount of honey produced per hive is very variable. Thus, for traditional hives the average amount of honey produced is approximately 10Kg per hive, while framed hives yield an average of 20Kg/ per hive [14].

In Ethiopia, about 5 types of movable frame hives were introduced since 1970 [23] and the most commonly used are: Zander and Langstroth style hives. Based on the national estimate, the average yield of pure honey from movable frame hive is 15-20 kg/year, and the amount of beeswax produced is 1-2% of the honey yield [21]. However, in potential areas, up to 50-60 kg harvest has been reported [23]. Movable frame hives allow colony management and use of a higher level of technology, with larger colonies, and can give higher yield and quality honey but are likely require high investment cost and trained man power.

Modern movable- frame hive consists of precisely made rectangular box hives (hive bodies) superimposed one above the other in a tier. The number of boxes is varied seasonally according to the population size of bees. Practical movable- frame hive was invented in 1851 by Lorenzo Lorraine Langstroth in U.S.A. [8]. Later on different countries developed their own movable frame hives (for instance Zander, Dadant) and Langstroth was the prototype of movable frame hives used today. In many countries Langstroth hive boxes have proved to be convenient for handling and management.

IV. SOCIO-ECONOMIC IMPORTANCE OF BEEKEEPING IN ETHIOPIA

Beekeeping is an important component of agriculture and rural development program in many countries. The role of beekeeping in providing nutritional, economic and ecological security to rural communities at the household level and is an additional income generating activity. This, being a non-land-based activity, does not compete with other resource demanding components of farming systems [15]. Beekeeping has been part of the farming system in Ethiopia since time immemorial. It has been a tradition since long before other farming systems. Beekeeping is a very long-standing and deep rooted practice in the rural communities of the country and around one million farmers are estimated to keep bees [26]. Beekeeping has been and still

plays a significant role in the national economy of the country as well as for the subsistence smallholder farmers. The contribution of bees and hive products, though difficult to assess, is probably one of the most important small-scale income generating activities for hundred thousands of farmer beekeepers. According to [6] honey has value as a food, as a medicine, as a cash crop for both domestic and export markets and as an important part of some cultural traditions. At times of food shortage it is a useful carbohydrate source that contains trace elements and adds nutritional diversity to poor diets. Honey often has an important place in traditional food preparation.

Honeybee is also believed to play a significant role in the economy of Ethiopia through pollination services. Pollination is one of the most important factors that affect seed production in agricultural crops. In Ethiopia, an experiment was conducted to evaluate the effect of honeybee pollination on Niger (*Guizotia abyssinica*) and the result revealed that honeybees increased the seed yield of Niger by about 43 percent [2]. These indicated that honeybees have a vital role in increasing food production and overall agricultural productivity.

V. MAJOR CONSTRAINTS TO HONEY PRODUCTIVITY IN ETHIOPIA

Ethiopia has enormous unexploited potential for promoting beekeeping; both for local use and for export purpose. However, the country is back in the transformation promotion, scaling up to rapid growth, in commercial beekeeping development and marketing. Therefore, like any other livestock sector, this sub sector has been ceased by complicated constraints. The prevailing production constraints in the beekeeping sub sector of the country would vary depending on the agro-ecology of the areas where the activities is carried out [12]. Variations of production constraints also extend in socio-economic conditions, cultural practices, climate (seasons of the year) and behaviors of the bees. These create deforestation, soil erosion and irreversible ecological degradation. Moreover, burning of undergrowth and destroying of forestland for expansion of farmland could trigger a reduction of honey producing floras and foraging areas. The elimination of good nectar and pollen producing tree species in many areas makes it difficult to maintain bee colonies without feeding [6]. According to [23], [4], [12], the major constraints in the beekeeping sub sector are the following: the unpleasant behaviors of bees (aggressiveness, swarming tendency, and absconding behaviors); lack of skilled manpower and training institutions; low level of technology used; high price of improved beekeeping technologies; drought and deforestation of natural vegetation; poor post-harvest management of beehive products and marketing constraints; indiscriminate application of agrochemicals; honeybee disease, pest and predators; poor extension services; absence of coordination between research, extension and farmers; absence of policy in apiculture; shortage of records and up-to-date information; and inadequate research institutions to address the problems. But all these problems may not be constraints to all parts of the country and may not be equally pressing to every place. So it requires characterizing the constraints in their respective places to take an appropriate development measure.

For beekeeping research in Ethiopia Holeta Bee Research Center (HBRC) is the main mandated institution undertaking applied and adaptive apicultural research that would support development [12]. The beekeeping research so far conducted in the country although encouraging is not satisfactory because one center could not address all parts of the country. Most of the research work is still being carried out on-station with modern technology and management systems. However, the great majority of beekeeping production is based on traditional production systems where the results of on-station research may not often be applicable to the local conditions.

Beekeeping working tools and equipment that have been used in Ethiopia are all locally made and of poor standard. The effort made in the introduction of improved tools and equipment to the rural community even though appreciated but cannot be affordable for the pockets of farmers and not so easily available even for those who could afford it. High capital investment requirements and the lack of credit facility designed for the sector was very limited. Quality standard of Ethiopian honey is low as a result of many poor post-harvest treatments like; poor containers, storing room conditions, and many other ingredients mixed in are among some to mention. A study carried out by the Holeta Bee Research Center (HBRC) based on sample honeys collected from the southwestern parts of the country found that the amount of pure honey obtained from processing ranges from 34.6% to 97.6%, with the mean being 73.15% while the average waste matter was found to be about 29.2%. A study report by the [24] showed that the compositional content of Ethiopian honey falls in the range of good quality compared to world standards set for determining the quality of honey.

VI. CONCLUSION

Honey production and quality in Ethiopia is influenced by beekeeping practice, lack of skill, agro-ecological zone, type of bee flora and type of hives. The production and productivity of honey among the three types of Ethiopian hives is more in modern than traditional and transitional once, but Ethiopian farmers resist adapting modern bee hive due to its high price and accessibility. Ethiopia is highly potential for various bee flora and colony population as compared from other African countries. The management and human skill to harvest and processing honey and the other hive products not specialized and required continuous training and support to our community.

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