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HONEY PRODUCTION PRACTICES AND CHALLENGES IN SELECTED KEBELES OF DIRE ENCHINI DISTRICT, WEST SHOA ZONE, OROMIA REGIONAL STATE, ETHIOPIA

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MSc. THESIS

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DEDICATION

I dedicate this thesis manuscript to my brother (Lamessa Fufa), my Wife (Bontu Damessa), my Son (Nafyed Gadisa) and all my friends for helping me during the study with love, hospitality and for their dedicated partnership in the success of my life.

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LIST OF ACRONYMYS

AGRDO: Agricultural Rural Development Office

CSA: Central Statistical Agency of Ethiopia

DA: Development Agent

FAO: Food and agricultural organization

HBRC: Holeta Bee Research Center

HB: Honey Bee

MOA: Ministry of Agriculture

MOARD: Ministry of Agriculture and Rural Development

NHB: National Honey Board

PA: Peasant Association

SPSS: Statistical Package for the Social Sciences

NGOs: Non-governmental organizations

ABSTRACT

Any member of the Genus Apis that stores honey and builds wax nests that are permanent colonies is known as a honeybee. Honey is a natural food that honeybees make from nectar or other floral secretions mostly. This research was carried out in Dire Echini District West Shoa zone, Ethiopia to survey the opportunities and challenges of honey production in *2023/2024. Three Kebeles namely, Bola Demeka, Buyama Debale and Bola Roge were randomly selected. A total of 335 respondents with differing number from each Kebele were selected Stratified random sampling.. The semi-structured interviewed, structured questionnaire, focal group discussion and formal field survey method were used to collect the primary data. The major pests and predators of honey bee were ants, beetles, spiders, wasps, lizard, birds and honey badger. The results of the household survey showed that 74.7% of the hives owned by the bee keepers was traditional. About 64.2% beekeepers of the respondent were using honey for income. The data showed that about 51.6% of household respondents replied that the sources of honey bee colony are from the beehive itself. About 47.5% of honey production was influenced by ant and also about 46.6% of honey productions were affected by climatic condition such as high rain fall and humidity especially august month in this district. Majority of actors placed their hive on the roof and also about 50.1% of beekeepers harvested the honey in December. Therefore, using robust (strong) extension and technical assistance is crucial for farmers to use modern technologies in honey production and reduce different factors that hinder honey production in these districts. The opportunities for honey production and apiculture in the research area were the existence and abundance of honeybee colonies, young people potential and presence of possible flowering plants, abundant supplies of water for bees, Indigenous beekeepers knowledge & experience and socio-economic value of honey.*

Key words*:* - Beekeeping, Honeybee colony, Honey production, Traditional, opportunities, challenges

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CHAPTER ONE

1. INTRODUCTION

1.1. Background

Bee keeping practice had been an old age historical practice. The relationship between humans and honeybees in Africa takes several forms: honey hunting is practiced in many countries (Hepburn and Radloff, 2013). Ethiopia is one of the countries in the continent which possess huge honey production potential. Owing to its varied ecological and climatic conditions, the country is home to some of the most diverse flora and fauna in Africa. This diversity makes it highly suitable for sustaining a large number of bee colonies Netsenat Adgaba (2007). Traditional beekeeping based on keeping colonies in woven baskets, clay, bark, grass or log hives is widespread in some countries whereas others adopted modern beekeeping technique ensuing hives with removable frames (Johann Smear et al., 2001). Bee keeping or apiculture entails the rearing or keeping of bees with the aim of exploiting its products which includes honey, pollen grain, propolis, and comb (Cornelissen et al., 2019)

In Ethiopia, apiculture is a traditional occupation widely practiced by farmers as a resource combined with suitable climatic condition making the country favorable for the beekeeping sector Nuru Ahmed et al., (2001). Accordingly, beekeeping is a well-accepted household activity throughout the country. Ethiopia has the highest bee colony density in Africa. It is estimated that around one million farmer household keep bees. Currently, traditional beekeeping accounts for more than 95 percent of honey production and almost all the bees wax produced in the country and the remaining 5 percent includes transitional and modern beekeeping (CSA, 2010).

The total annual honey and beeswax production is more than 5368 tons and 4700 tons respectively (CSA, 2010). This makes Ethiopia the fourth largest beeswax and tenth largest honey production country in the world. Export of honey and bee wax estimated to contribute 3.48million US$ to the annual national export earnings. It has attractive chemical properties for baking and distinctive flavor when used as a sweeter. Most micro- organism does not grow in honey, so sealed honey does not spoil, even after thousands of years. Beekeeping is still operating in the old traditional ways implying the need for modernization. Low productivity and poor quality of bees' products are the major economic impediments for rural beekeepers (Nuru Ahmed, 1999).

In developing nations, honey bee also important for maintain their natural biodiversity and reduce poverty, beekeeping is an environmentally beneficial activity Peregrym et al., (2016). It has also been contributing to rural households' income and adding to national economy in Ethiopia (Gemechis Lemma, 2015). It has a significant impact directly by providing important products like queen, beeswax, honey and bee colonies, and other things such as pollen, royal jelly, bee venom and propolis, and indirectly by providing nutritional, economic and ecological security.

The major constraints in the beekeeping sectors are the following: lack of skilled manpower and training institutions, low level of technology used, high price of improved beehive, drought, deforestation of natural vegetation, poor post-harvest management of honey, marketing constraints, indiscriminate application of agrochemicals, honeybee disease, pest and predators, poor extension services, absence of coordination between researcher, extension and farmers, and inadequate research institutions to address the problems Mulugeta Asebu (2021). But all these problems may not be constraints to all parts of the country and may not be equally pressing to every place. Thus, it requires characterizing the constraints in their respective places to take an appropriate development measure (HBRC, 1997, Ayalew kassaye (2001) and Edessa Negera (2002).

1.2. Statement of the problem

By its very nature, beekeeping doesn't require a large plot of land and sophisticated technological expertise. The common obstacles in honey production are honeybee foraging areas due to crop intensification, the growing in use of agrochemicals, extreme weather conditions in some parts of Ethiopia (droughts); poor transportation infrastructure, weak knowledge of proper storage techniques (at the farm and local honey collectors (traders' levels), problems with packaging, especially at the processors level (e.g., difficulty obtaining a reliable supply of glass jars), weak access to profitable export markets due to low productivity, limited knowledge of export-market requirements and lack of or weak connections with processors.

In Dire Echini District, large proportion of inaccessible lands for agriculture are covered in a variety of tree, shrub, and field flower species that create this part of the regions still potential for beekeeping. However, it takes work to address some of the main issues with beekeeping and to maintain its productivity in the environmentally friendly manner. Thus far in the district, there is a lack of comprehensive and trustworthy data regarding the system for producing and marketing honey. Furthermore unknown were the quantity of honey produced, the number of beekeepers, the size of the bee colonies, the sort of beekeeping that was done, and the limitations. Thus, the purpose of this study was to gather data on the productivity of honey production, the limitations associated with beekeeping in Dire Echini district.

1.3. Objective of the study

1.3.1. General objective

To investigate honey production opportunities and challenges in selected kebeles of Dire Enchini District

1.3.2. Specific objectives

- To assess the opportunity present in honey production system
- To assess a kind of hive do people use and its effect on honey production
- To assess the challenges of beekeeping and honey production

1.4. Research question

- What are the opportunities present in honey production practices
- What kinds of hive do people use and what are their effects on honey production
- What are the challenges of beekeeping and honey production

1.5. Significance of the study

This study was developing awareness in the community about the challenges and opportunity of honey production. To identifying the kinds of bee hive and their productivity in honey production, indicating the factors that need great attention and identifying the aspects that need further research work on honey production. It indicates direction and supply information for further research, extension and development efforts, for non -governmental organization whose main concerns may be to invest on these sectors. For improving honey production technologies

1.6. Scope of the Study

This study was confined to Dire Enchini district and focuses on assessing of factors associated to honey production at three Kebele from this district. Even though it is difficult to deal with all kebeles of the district, so studying some specific area has had great importance for through investigation. In order to assess the factors, researcher attention is to look in to honey production and beekeeping.

CHAPTER TWO

2. LITERATURE REVIEW

2.1. Honey Bee

The European Honey Bee or *Apis mellifera* is the species of honey bee that most commonly used in beekeeping around the world. They are eusocial, meaning that they live in organized colonies, and are considered advanced social insects because they are able to live in colonies that last multiple years and are exceptional at communicating with one another. Honey bees fall in the kingdom Animalia, Phylum Arthropoda, Class Insecta, Order Hymenoptera, Family Apidae and Genus *Apis* by following Linnaeus classification system Kaplan, N., & Lineal, M. (2006)

Any member of the genus *Apis* that stores honey and builds wax nests that are permanent colonies is known as a honeybee Engel, et al., (2021). At the moment, just seven species of honeybees acknowledged, with forty-four subspecies. However, Six to eleven species have existed historically were recognized. The western honeybee, which has been domesticated for honey production and crop pollination, is the most well-known type of honeybees. Honeybee represents just a tiny portion of the over 20,000 species of bee Johnson, B. R. (2023). In Ethiopia there are five types of honeybees found in different ecological namely: *Apismellifera adansanii* exists in south and western part of the country, *Apismellifera jemenitica* is found in the low land areas of eastern Ethiopia, *Apismellifera monticola* exists in Southeast Mountain of Bale-Dinsho, northern high and mountains part of the country, *Apismellifera litorea* exists in southwest low lands, *Apismellifera abyssinica* exists in highland area of central, west and southern parts of the country Bahita, H. T. (2018). Only bees belonging to the genus Apis are considered to be true honey bees; other related bee species, such as stingless honey bees, also make and store honey (Michaels and Engel, 1999).

2.2. Honey

Honey is an organic material which is made by honeybees, particularly those of the *Apis mellifera* species, with a sweet taste and thick consistency. According to Havsteen, 2002, honey has been used from the beginning of human history and is likely the first sweetener to be found by humans. In fact, honey is said to have been a part of the Paleolithic diet (Eaton, 2000). Honey get its sweetness derived

from the monosaccharide, fructose and glucose, and has about the same relative sweetness as granulated sugar (National honey Board, June 2012). It has attractive chemical qualities for baking and a unique taste used as sweeter. The majority of microbes cannot grow in honey, so sealed honey does not spoil, even after thousands of year (Geiling, 2013)

Honey is the oldest sweetener existent in the world since the evolution of human while the accurate date of origin of this sweetener remains unknown. The use and production of honey have a rich and diverse history. In Egypt, archaeologists have found honey comb that were been interred in tombs at the honey remained edible even for the Pharaohs (Heathmont, 2013). Honey is commonly employed as a sweet symbol and as a talisman. Gathering honey is a long-standing tradition. Humans began using honey at least 10,000years ago as it is evident with a cave painting discovered in the early 1900's in Valencia, Spain in the Cave of the Spider situated on the river Cazunta (Bogdanov, 1999). In Ancient times, people of Egypt use honey to make cookies and cakes sweeter, and were utilized in numerous different recipes. Ancient people of Egypt and the Middle Easterners often embalmed the deceased with honey (Mielidautore, 2013).

According to Aristotle “eating honey prolongs life” while Hippocrates says “I eat honey and use it in the treatment of many diseases because honey offers good food and good health”. Pedanius Dioscorides (2006) a Roman surgeon in army has wrote in his book that “Honey could be used as treatment for stomach disease, wound with pus, hemorrhoids, and treatment to stop coughing.” In the Roman Empire, honey was used instead of gold to pay taxes. Honey was used as a sweetening agent in Roman recipes which is quoted by several Roman authors including Bass us, Cato and Athenaeus. Some of these are collected in the book Roman cookery (Martos et al., 2000). In the book Naturalist Historian, Pliny the Elder has wrote about bee and honey and its usage (Riley, Henry T. 2007). However, the Chinese went ahead the rest of the world in terms of preserving the honey, consuming and collecting it, as they were first to begin beekeeping (Fan li, 2006)

2.3. **Honey production System in Ethiopia**

Even in the modern period, honey harvesting is still a fairly prevalent practice in many parts of Africa, including Ethiopia. In some households in certain parts of Ethiopia make their living only from hunting honey and rearing forest bees and beekeeping practiced in the country for the use of honey for commercial purposes. In areas where untamed bee colonies reside in hollow trees and caves discovered, honey hunting continues to a common practice in Ethiopia Tessega Birhanu (2009).

According to Ayalew Kassaye (2008) reported that currently in Ethiopia, beekeeping practiced in three categories of production specifically, conventional, transitional and frame beehive beekeeping. Ethiopia, having the highest most abundant source of honey is flora, both in terms of bee colonies and extra honey production and beeswax in Africa. Habtamu Kebede & Netsenat Adgaba (2011). About 23.6% and 2.1% of all honey produced in Africa and the world, respectively, comes from Ethiopia Abebayehu Tadele et al., (2016). It is among the top ten nations in the world for honey production as well as the top producer in Africa.

Honey in Ethiopia is generally produced as a cash crop, with yearly sales amounting to 90 to 95 percent of total production.The major honey and beeswax producing regions are Oromia (41%), Amhara (22%), SNNPR (21%), and Tigray (5%). Currently, the majority of honey produced, about 70 percent is sold to tej houses. The remaining portion is marketed as table honey for general consumption (Beyene Tadesse and Phillips, 2007). The same trend to in this study area tej is cultural drink and most honey produced was solid for tej house next to home consumption.

2.3.1. **Traditional Beekeeping**

The oldest and most prosperous type of beekeeping that has been practiced is traditional beekeeping by the people for thousands of years in Ethiopia. This beekeeping practice is extensive and closely tied to swarm management: beehives are suspended up to capture swarms and in trees are then transferred and placed in the backyards with some kinds of hive sheds that protects them from the hot temperature and rainforest Cotton, L. E. (2024). Traditional beehives (30-40 cm across and 1 m long) are made by shaping branches, straw, cow dung, and clay into the shape of a tube. But, sometimes hives can be made from soft logs of a cactus tree (Gallmann and Thomas, 2012). As reported by, Beyene Tadesse and David (2007) under Ethiopian farmers' management condition, the average amount of crude honey produced from a traditional beehive is estimated to be 8 to 15 kg per harvest/beehive/year in which about 8-10% of its weight is beeswax. However, this harvest is achieved with minimal cost and labor, which is valuable to people living a marginal existence (Tessega, 2009). This beekeeping practice may differ from place to place and beekeeper to beekeeper based on the resources and knowledge in the area. Accordingly, two types of traditional beekeeping practices are found in the country (forest beekeeping and backyard beekeeping). In certain regions of the nation, particularly in the west and south, forest beekeeping is widely practiced by draping several conventional beehives on the trees (Ramasawmy, M. R., 2017).

In the other, much of the nation, backyard beekeeping under somewhat better supervision is the norm and dominant type of beekeeping (Nuru and Adgaba, 2002); However, traditional beehives in this system have their own disadvantages on colony management and honey harvesting activities including: difficulty in colony inspection for brood diseases, difficult to work with open hives in the night, not appropriate for artificial queen rearing, higher chance for a number of bees and a queen to be killed during operations, very difficult yield and behavior targeting selection. Furthermore, colony

feeding during times of food shortage is not easy and appropriate, difficult to judge ripeness of honey before harvesting, low quality honey harvest, brood, nectar and pollen storing combs will be destroyed during harvesting.

2.3.2. **Transitional Beekeeping**

Transitional system, which has been speculated to be started in Ethiopia since 1976, is a type of beekeeping which is intermediate between traditional and modern beekeeping Esayas Mekonnen (2016) Transitional (intermediate) beekeeping practice has different advantages over traditional system. These include: hives readily and swiftly opened, the bees are directed to building parallel and unattached combs after individual top bars, because top bars are readily detachable, beekeepers can work quickly, top bars are also easier to construct, when harvesting honeycombs, they can be taken out of the hive without disrupting the combs that hold the larvae, beehives can be strung using ropes or cables, providing pest protection

However, transitional beekeeping has its own disadvantages such as top bar hives are relatively more expensive than traditional beehives, and combs suspended from the top bars are more apt(suitable) to break off (HBRC, 2004). Thus, as reported by, HBRC (1997) the types of beehives used more frequently in this system are the Kenyan top-bar hives (KTBH), Tanzania top-bar hives (TTBH) and Mud- block hives (MBH). Among these, KTBH is widely known and commonly used in many parts of the country. At the moment, intermediate or transitional beehives that are either locally manufactured or the top bar hives in Kenya “chefeka” hives. According to Workneh et al., (2008) the honeybees have accepted the Chefeka hive made from locally available materials. In Ethiopia the data indicated that, the average productivity of traditional hive was 4-8 kg/hive/year, transitional hive 7-21 kg/hive/years and frame hive produce 12-32kg/hive/years

2.3.3. **Frame Hive Beekeeping**

The main purpose of frame hive beekeeping method aim is to produce high quality of honey possible without endangering bees, season after season (Nicola, 2002). Accordingly, it uses different types of frame hives (Zander and Lang troth hives being common in the country, Dadant, Modified Zander, and foam hives are also found). However, these hives basically differ in the number and size of frames. Generally, frame hive consists of a precisely constructed rectangular boxes superimposed one above the other within a tier. Similarly the number among boxes (suppers used) varies with season, population size and activities of bees. As reported by, HBRC (1997) these box hives have an advantage over the others in the volume and quality of honey harvested (averagely 15-20 kg/year and in potential areas up to 50-60 kg harvested). Moreover, the hives allows swarm control through spring and colony management, it is easy to transport and allows the use of higher level technologies. However, equipment in this beekeeping system are relatively expensive, require skilled manpower, very less wax production only 1-2% of the honey yield (Gezahegne Tadesse, 2001).

2.4. **Economic Importance of Honey**

In Ethiopia, honey production is present in many parts of the country. Simplicity of the production system, low costs and favorable conditions result in production processes that appear everywhere (JG Meshesha, K Gardebroek, 2011). Especially, for resource poor farmers with no or little land, this activity is a main source of income. In addition to their financial value, honey and beeswax have many cultural values and form part of ceremonies for birth, marriages, funerals, Christmas and other religious celebrations in many societies. Beekeepers are generally respected for their craft. All of these aspects are livelihood outcomes from the activity of beekeeping. While some may be difficult or impossible to quantify, they are real outcomes that strengthen people's livelihoods and therefore should be acknowledged by a beekeeping intervention (Brad bear, 2009). In addition to honey

produce, honey bee also produce different products such as bee venoms, Royal gelly, propolis and bee pollens

2.4.1. **Employment**

In addition to improving food security, beekeeping and honey production creates jobs, particularly in places where there was population pressure on the environment (Illgener et al., 1998). This aids in household financial management shock lowering the level of vulnerability in these households. Since honey production is a customarily well-established domestic practice in nearly all of Ethiopia, it contributes to rural employment. The employment effect of honey production includes farmer, traders, bee equipment producers, local tej makers and processors. The exact number of people engaged in the honey production is not well documented. However, it is estimated that around one million farmer households are involved in honey production (MOARD, 2005/06).

2.4.2. **Nutritional and Sugar Profile of Honey**

Honey contains antioxidants, minerals, vitamins, proteins, and a high amount of calories value, which showcase appealing components absent from artificial sweeteners (Alkire and Foster, 2011). Honey additionally employed in Africa to create traditional beer, mostly for religious and cultural reasons. Honey consumption enhances meal absorption; reduce infectious gastrointestinal issues, such as liver abnormalities, duodenal ulcers, and constipation, which raise proper food utilization (Krell, 1996).

A 100-gram serving of honey offers 304 kilocalories without any necessary insignificant content of nutrients (USDA, National nutrient Database). Honey is mostly made up of 82% carbohydrates and 17% water, with very little fat, dietary fiber, or protein. Honey is mostly composed of fructose and glucose, along with maltose, sucrose, and other complex carbohydrates (NHB, 2012). Its glycemic index varies according on the cultivar, from 31 to 78, (Brand, Milew, 2008). The specific composition,

color, aroma and flavor of any honey batch of honey depend on the flowers foraged by bees that produce the honey Soares et al., (2017).

2.4.3. **Medicinal Value/Traditional Medicine**

Honey primarily seen in traditional medical system as had curative properties. This derives from the fact that honey made from particular medicinal plant (FAO, 2009). On a topical application honey has demonstrated accelerated wound healings in animals Rashidi et al., (2016). More over common bacteria Streptococcus, progenies that cause sore throats can be inhibited from growth by the use of honey (FAO, 2009). In terms of beeswax, claims are made that it has antibiotic properties and can be used for arthritis and nasal inflammation (FAO, 2009).

2.4.4. **Crop pollination**

Agriculture is the main sector providing income, employment and food for roughly 85% of Ethiopia's population residing in the countryside of the country. Economic growth of the country, therefore, depends on the prosperity and economic growth of the rural areas, which depends directly or indirectly on crop productivity through tremendously neglected pollination services from insects including honeybees (Nuru, 2000). In addition, most of the cultivated crops are cross-pollinated, which are mostly visited by them honeybees for the collection of pollen, nectar or both where on the way provide their most valuable pollination services. Pollination service provided by the honeybees is considered as a fortune by-product as pollinators of over 100 cultivated crops. In this regard, honey production, which is always so closely associated with honeybees in the eyes of laymen, pastels into insignificant when compared to the value of the pollination services provided by this insect. So, it is interesting sometimes to note the value of honeybees as pollinators from the figures for the value of honeybees to the agricultural economy.

To take an example, in 1987, only in the United States of America, honeybee's pollination Value was estimated to be about US$ 9.3 billion Madras-Majewska, B., & Majewski, J.(2016, April). This would be crucial to comprehend the ways in which pollination services of honeybees are supporting lives of millions of people in Ethiopia as well. Consequently, in Ethiopia, an experiment was conducted to determine the effect of pollination on Niger (Guizotia abyssinica) and the result showed that honeybees improved Niger's seed production by almost 43% (Admasu , 2000).

2.4.5. **Honey Production as a gender friendly Activity**

In the majority of African nations, beekeeping activity has historically been dominated by men (Ogaba and Akongo, 2001). But thanks to development agencies' intervention, there has been a shift in these practices could occur. Traditionally, in most African Societies, the norm has had been that men reserved the right of making most of the decision at household level. Therefore women have had less owner ship and authority over resources less decision making capacity and fewer educational and economic possibilities than men.

Consequently, developmental initiatives affect male and female beneficiary in varying ways due to gender difference and inequalities. In addition, women often encounter obstacles that prevent them from participating in and benefiting from development projects. Therefore, deliberate consideration of gender dynamics for understanding how developmental initiatives lead to change in gender roles was paramount. According to Ogaba and Akongo (2001), a few of the elements that deprived Ugandan women's participation in beekeeping include lack of time to collect honey at night.

2.5. Challenges in Honey Production

2.5.1. Natural Enemies and Pests for Honey Bee Production

Predation and pest's infestation are major problems in Africa beekeeping industry. The predators include mammals, birds, reptiles, beetles, ants and wasps, flies Nagaraja, N., & Rajagopal, D. (2019). Among these predators, the honey badgers, honey guide birds and different species of ants are the most common. However, the recent reports indicate that man is the most significant predators to honey bees in Africa followed by honey badgers Johnson, A. S. (2019). This is because most honey gathers use crude method such as, use of fire to harvest and extract the honey from natural colonies thus destroying entire colonies. Further wax production had been identified as the most destructive action of honey bee nests recent reports show that about 1927 colonies are destroyed per metric ton of wax harvested per annual using traditional methods in the natural habitats in Africa (Hepburn and Radloff, 1998). The major bee pests in Ethiopia are wax moth, spider, ants, bee- eater birds, honey badger and beetles are the most serious problems to beekeeping development. Those pests are the most harmful in order to decreasing importance of beekeeping in Ethiopia. Bee colonies can be attacked by several diseases. Those diseases have causative agent like bacteria, protozoa, fungus, and virus. Generally, from those diseases Nosema, Amoeba, poisoning plants and chalk brood are found in Ethiopia (HBRC, 2005).

2.5.2. Climate Change

A climate change can affect the relationship between plants and their pollinators to decline honey bee population. In some cases, the flowering period of a plant may not correspond to the peak or emergence of its corresponding pollinator (Jump et al., 2002). How honeybees might be affected by such changes remains unknown. Although, honeybees are generalists, and forage on many plant species, and display remarkable plasticity to various environmental conditions. For example,

honeybees found in the oases of the Sahara are able to thrive in hot conditions by collecting water for evaporative cooling to thermo regulates the colony. Under cold conditions, honeybees will form tight clusters inside the hive and create heat by isometric ally contracting their thoracic muscles (Seeley, 1996)

2.5.3. **Effect of Land Degradation and Fragmentation**

In Ethiopia, the honeybee flora resources have gone through large changes because of land use change and deforestation (Abebe et al., 2008). Still deforestation is high in Ethiopia and it is a result of harvesting trees and shrubs for fuel wood, use of trees for house construction and selling trees for timber production (Lemenih and Kassa, 2014). Thus, increase in land use change and deforestation are inducing conditions that are hostile for sustainable beekeeping due to the destruction of natural honeybees' habitats, reducing forage and plant diversity and leading to insufficient nutrition and ultimate starvation of the honeybees. These situations are increasing, especially in the mixed crop-livestock production system

2.5.4. **Harmful Effects of Pesticides on Honey bees**

Chemicals called pesticides are used to get rid of unwanted pests. Unfortunately, honeybees are insects, and pesticides have a significant impact on them. Pesticides have received much attention by beekeepers as the primary cause of colony declines (Doucet-Personeni et al., 2003). There are several ways honeybees are susceptible to pesticide death. One is direct contact between the insecticide and the bee during its field feeding. The bee immediately dies and does not return to the hive. In this case the queen, brood and nurse bees are not contaminated and the colony survives (Vidau et al., 2011). The second, more deadly way is when the bee comes in contact with an insecticide and transports it back to the colony, either as contaminated pollen or nectar or on its body. Honeybee colonies that are exposed to pesticides typically have a large number of lifeless bees in close proximity to the hive.

Abrupt loss of the colony's field force is another sign. Exposure to pesticides may make them more susceptible to other diseases, such Nosema (Alaux et al., 2011). In addition to food, bees also drink water to keep their body temperature under control (Schmaranzer, 2000). Pesticide residues in soil eventually move into the water and appear in the stream. Creeks and ponds of agricultural areas beyond which are thus contaminated with a mixture of agrochemical

2.5.5. **Harmful Effect of Herbicide on Honey bee**

Herbicides are indirect effects caused by herbicides cannot be ignored. Herbicides are not toxic to bees, but they disturb the environment in which bees and other pollinators live. Plant biodiversity, and its associated arthropod communities, have certainly decreased in areas that have been treated with herbicides for many years (et al., 2011). The lack of certain plant species, mainly weeds, implies an impoverishment of the natural environment that sustains pollinators, including honey bees. Consequently, bees find more difficult to collect the variety of pollen that is required for a healthy bee diet. Poor bee nutrition due to scarcity of flowers is the indirect result of continuous herbicide applications in crops and forestry areas over many decades.

2.6. **Major constraints of beekeeping in Ethiopia**

Ethiopia has enormous untapped potential for promoting beekeeping; both for local use and for export purpose. However, like any other livestock sector, this sub sector has been ceased by complicated limitations. The current limitations on production in beekeeping sub sector of the nation would vary depending on the agro ecology of the areas where the activities is carried out (Edessa, N. (2005).

2.6.1. **High cost of modern bee hives**

Some of the honey production equipment’s such as modern bee hives, wax printers and honey extractors are very expensive and thus farmers could not affordable to buy and use these equipment’s. Currently, the price of one contemporary bee hive ranges from between 900 and 1000 ETB. The cost

of honey extractor is ranges 4,000-5,000 ETB and the cost of wax printer is ranges from 5,000-6,000 ETB. As a result of these, there is a shortage of appropriate technologies for production, collection, processing, packing and storage in the area. Improved bee equipment's to the district farmers are beyond their buying capacity and even is not easily available for those beekeepers who are afford to buy it. The participants also indicated that there is no microfinance institutions that financing or provide credit services for those farmers who want to invest in modern honey production in the district. Most of the district farmers were resource poor and thus they are unable to buy and use modern bee technologies to improve honey yield.

2.6.2. **Pests and predators**

Ethiopia, as one of the sub-tropical countries, the land is advantageous not just to bees but also to several honey bee pests and predators that interact with honey bee life Desalegn Belay (2001). Pests and predators cause a serious catastrophic harm to colonies of honey bees with in little time frame, sometimes even overnight. The principal bee pests and predators in the district were: wax moth, spider, ants, bee-eater birds, honey badger and beetles are the most serious problems to beekeeping development Mulugeta Asebu. (2021). This result agrees with the report of ants, honey badger, bee-eater birds, wax moth, spider, perhaps the most dangerous pests and predators that reduced the significance of beekeeping in the Amhara region were beetles (Teklu Giday. 2005).

2.6.3. **Shortage of flowering plants**

This problem is directly related to deforestation of forest coverage from time to time for timber making, construction, fire wood and expansion of agricultural lands. These are cause shortage of bee forage especially during the dry season. Most beekeepers of the district have been migrated their bee colonies from their area to other area during the dry season for searching bee forage. This increased the expense of farmers in the form of wage and cause colony loss through pests and predators. The

elimination of good nectar and pollen producing tree species in many areas make it difficult to maintain bee colonies without feeding (Teklu Giday, 2005).

CHAPTER THREE

3. MATERIALS AND METHOD

3.1. Description of the Study Area

3.1.1. Location

The study was conducted in Dire Enchini district which is located in West Shoa Administrative Zone, Oromia National Regional State, at about 154 km from capital city of Addis Ababa toward the western Ethiopia and 40km from Ambo Town. It is located at $7^0$52'-$8^0$03'N latitude and $37^0$21'-$39^0$41' E longitude, with an elevation of 2600 meters above sea level. This district is surrounded by Toke Kutaye, Jibat, Liben jawi and S/west shoa zone Amaya district in the east, west, southern and north parts respectively.

Dire Enchini Map

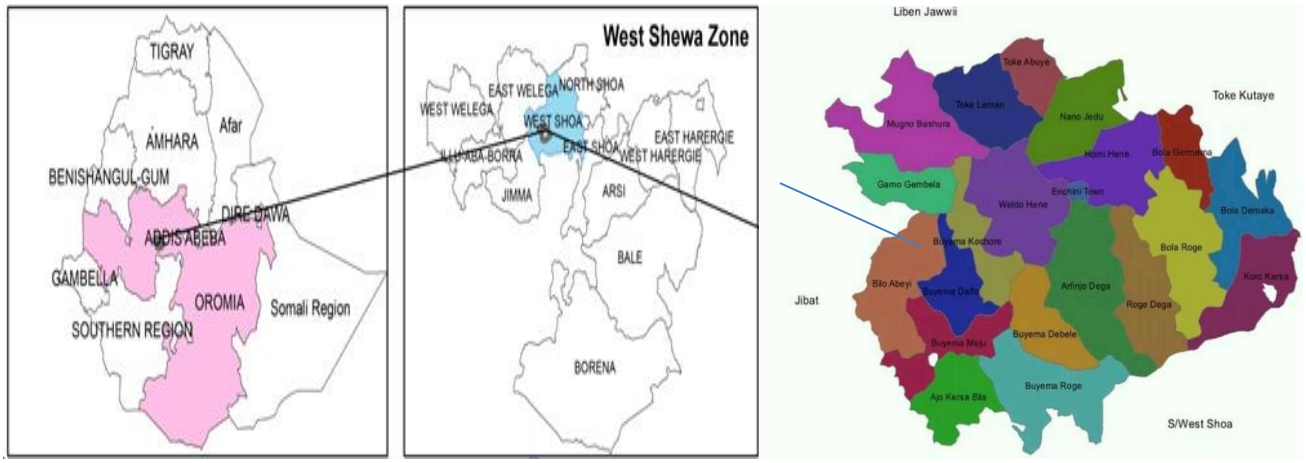

Figure 3.1: Location map of the study area

3.1.2. Population of the study area

According to 2019 unpublished data from the district, the district has 79182 total populations of them 36590 were males and 42592 were females. From these populations, 4484 of them are urban

populations were 2261 are males and 2223 are females. Dire Enchini District has 21 kebeles, of which 20 of them were rural (peasant associations) and 1 urban administrative kebeles.

3.1.3. **Socio-economic and Demographic characteristic of the study area**

As in most parts of the central high lands of the country, socio economically people of the district depend on mainly by agricultural practice like growing of cereal crops, including: barley, maize, wheat, Enset and domestic animals such as goats, sheep, cattle, mule, horses, donkey and poultry . The natural forest occupies a very small portion of the total landmass of the district. The traditional farming system, the potential of the area for cultivation and the economic condition forces the population in the area to exploit the forest extensively up to the foot of the escarpment. The end of 2007 E.C Oromia Regional State gave mandate, ownership and responsibility together with Oromia Forest and Wildlife Agency of Jibat-Gedo branch and now, there is a good opportunity to conserve, protect and afforest the surrounding foot bases of the forest and they have already planted *Pinus patula, Eucalyptus globules, Acacia mearnsii* and *Cupressus lusitanica*. Currently, both planted and natural forest are administrated and protected as State forests by Oromia National Regional State.

3.1.4. **Climatic Conditions**

The climatic conditions of this district is said to have a combination of sub-tropical and temperate climates (AGRDO, 2006). The average yearly temperature of this area is 22°c while the annual rainfall distribution is bimodal which ranges from 800-1200mm. Dire Enchini district experiences long rain and short rain season. The short rain is during May months while long rain is from June to August, with peak rain fall in august. The mean daily maximum temperature of this area is 22°c. Two main seasons can be recognized within the research domain. These are the rainy winter months which cover from September to November. The vegetation can get dry by this high cold during the morning. During these three months, days are generally warmer while nights were cooler. The hot and dry

season covers from December to February (ADO, 2016).Very little rain is experienced and temperature on the clear sunny may rise to as high as 22°centigrade.

3.2. **Research Design**

Data was conducted in the study area from the first week of October 2023 to April 2024 in order to collect important information such as rain fall, temperature, topography, agricultural status and the actual size of the study area which helps to select the representative study sites. The researcher (my research) purposively limited the study areas to Bola Roge, Bola Damake and Buyama Dabale kebeles that were highly prone to honey production.

3.3. **Sample Technique and Sample Size Determination**

One stage-sampling method was used to select sample kebeles and respondent of beekeepers. The first one was to identify the sample study kebeles, from 21 kebeles of Dire Enchini district. The next one was to identify sample households. Three sample kebeles, namely Bola Roge, Bola Damake and Buyama Dabale were selected purposively based on beekeeping activities which were more honey producing areas. Then, the sample households (farmers) from the three selected kebeles, which include 2059 households, was selected following mathematical formulas which(Yamane, 1967) and was calculated as follows: $n= \frac{N}{1+N(e)^2}$

Where N is Total number of house holder, 1 is designate the probability of the event occurring and e is designates maximum variability or margin of error 5 %(0.05).

$$n= \frac{N}{1+N(e)^2}$$

$$= \frac{2059}{1+2059(0.05)^2}$$

$$= \frac{2059}{6.1475}$$

$$=335$$

3.4. Data Types and Sources

In order to fulfill the aims of the study, information was gathered using both primary and secondary sources. The original (primary) sources of data were generated through questionnaires, Focus Group Discussion and field observation. Various published and unpublished documents were used as secondary sources of information for this study to make the study complete.

3.4.1. Primary Data Collection

The main data collecting instruments of primary sources is interviewing and standard questionnaire, Group Discussion with village leaders, extension workers, and district agricultural office.

Household interview was used to select the sample households for this study and discuss with district experts, cooperative members and model beekeepers. Accordingly 111 beekeeper households from Bola Roge, 110 beekeeper householders from Buyama Dabale and 114 beekeepers of households from Bola Demeka kebele were used for the structured questioner and interview.

Data were gathered using simple and contingent item questions, closed and open ended (mixed) surveys, and since this was a suitable method for collecting data from responders that were scattered over larger geographical area. The formats of responses to closed-ended questions were several options and ‘yes’ or ‘no' types and open-ended questions were also enables the respondents to write achievable suggestions, which the respondents think, were included. Formal survey was carry out to gather data formally through structured questionnaires (appendix I) that were filled out through face to face and direct interview of respondents. Primary data were therefore use in order to get first-hand information from respondents and it helped in providing information for specific purpose of addressing the issues needed at hand so that questionnaires were prepared and distributed to sample respondents to gather necessary information for the study. The copies of questionnaires were distributed to 335 sampled populations (selected respondent)

3.4.2. **Secondary Data Source**

To obtain secondary data such as total population of house hold in the district, unpublished document from Dire Enchini Agricultural office and statistic office were used

3.5. **Methods of Data Analysis**

The data was described by percentages to quantify numerical data relating to the study results and presented in the form of tables, chart, and graphs, would be used to analyze the demographic characteristic, season of honey harvesting, types and cost of bee hive, placement of beehive and factors affecting of honey productions.

3.6. **Ethical Consideration**

In questionnaires and interviews that may interfere with values, norms and cultures of society were not provided for respondents. The researcher collected data depending up on the willingness and interests of the respondents and their names were not mentioned.

CHAPTER FOUR

4. RESULTS

4.1. Socio-Economic and Demographic Characteristics of Respondent

In this study 80% of the respondents were males and the rest 20% were females. From house holder sampled of the respondents 23.6% of them were in age range of 14-30 ages, 31.6% of the total respondents were between 31-50 years old, about 26% of the respondents were between 51-65 years old and 18.8% of the respondents were greater than 65 ages. The marital status of respondents in this study area, about 82.7% of house holder the respondents were married, whereas 17.3%of the respondents were single.

Out of the total respondent of households about 35.5% could not read and write (illiterate), about 31.9% of the respondents were able to read and write but their education level were < grade 6, about 11.6% of the respondent were grade 6-8, about 11% of respondent were attended grade 9-12, about 2.7% of respondent were degree holder and about 7.2% of the respondent were diploma holder

Table 4.1 Socio-Economic factors of study subjects in three kebeles of Dire Enchini distinict

Item	Description	Frequency	percentage
Kebele	Bola Demeka	114	34.1
	Bola Roge	111	33.1
	Buyama Debele	110	32.8
Sex	Male	268	80
	Female	67	20
Age	14-30	79	23.6
	31-50	106	31.6
	51-65	78	26

	>65	63	18.8
	Cannot read and write	119	35.5
	Reading and writing but Education level is < grade 6	107	31.9
Education	grade 6-8	39	11.6
Status	grade 9-12	37	11.0
	College diploma holder	24	7.2
	First degree holder	9	2.7
Marital	Married	277	82.7
Status	Single	58	17.3

4.2. **Hive types and affordability**

From household sampled respondent, about 74.7% of respondent were using traditional bee hive for honey production, while11.6% of respondent were using transitional bee hive for production of honey, In addition 13.7% of respondent were using modern hive for generating of income from production of honey.

The change in honey bee hives and costs of hives based on the study for honey production. In this study area, there is an alternative of bee hive for production of honey as their ability to buy and use it. The costs of modern bee hive in this study area, about 6.3% of households respondent response that the cost of beehive were cheap for honey production, about 8.1% of households respondents replied that the cost of the beehive were fair, about 50.7% of households participants showed that the costs of the beehive were expensive and also about 34.9% of the households respondent answered that the cost of the beehive were very expensive.

Table 4.2 Hive types and their affordability status according to respondents.

Respondent categories		Frequency	percentage
Kind of beehive for Honey production	Traditional	250	74.7
	Transitional	39	11.6
	Modern	46	13.7
The costs of bee hive in the area	Cheap	21	6.3
	Fair	27	8.1
	Expensive	170	50.7
	Very expensive	117	34.9

4.3. **Source of Honeybee Colony**

The source of HB colony and methods of collection in this district were explained, in which about 51.7% of respondents obtained honeybee colony from beehive itself, about 12.5% of respondent are honeybee colony from migratory bee, about 0.3% respondent got HB colony from cave and about 35.5% of respondents were got from forest that found their area.

4.4. **Placement of bee Hive by Bee Keeper**

Data from field survey showed that, about 46% of respondents were kept their beehive on the roof, about 34.9% of respondents kept their beehive at back yard, about 19.1% of respondent from the sampled placed their beehive at closure area.

Table 4.3: Sources of HB colony and placement of beehives

Respondent categories		Frequency	percentage
Source of HB Colony	Forest	119	35.5
	Hive itself	173	51.7
	Migratory bee	42	12.5
	Cave	1	0.3
	Backyard	117	34.9
The placement	under roof	154	46
Of bee hive	In enclosure area	64	19.1

4.5. Seasonal based Honey Production in Study Area

The study revealed that there are two main honey production periods. The first peak is December-November, about 50.1% of respondent in December; about 16.4% of respondent showed November and the second peak included April-June, about 22.2% of respondent from household were in June and also 11.3% of respondent from household were in April.

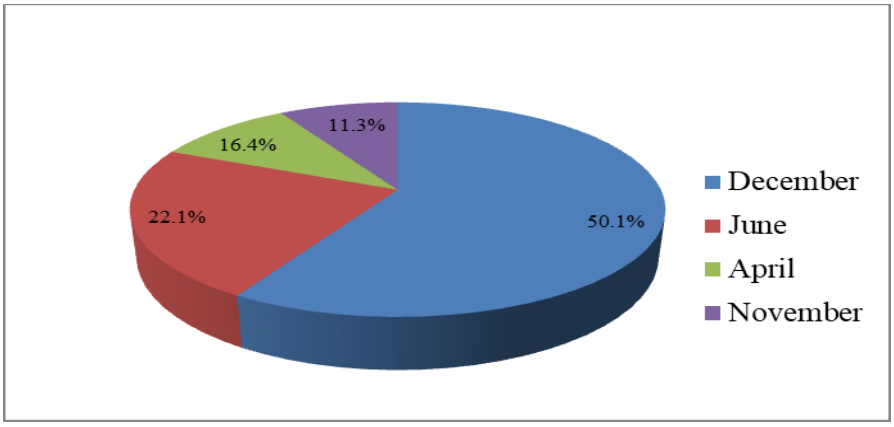

Figure 4.1: Main honey harvesting periods in study area

4.6. Major plants used by bees and practice followed to forage bees

According to the results of this survey, the honeybee plants of the study area composed of trees, shrubs, herbs and cultivated crops which are a source of nectar and pollen. As the type and source of food determines the success of beekeeping and honey production, the respondents were asked to indicate the source of feed for their bees. The respondents replied that 83.9% bees collect their food from flowering of flora plant, about 13.1% of respondents answered the bees get their foods from the fruit juice of the plant such as apple and also about 3% of the respondents replied the bee gets their foods from solute sugar provided by beekeeper itself.

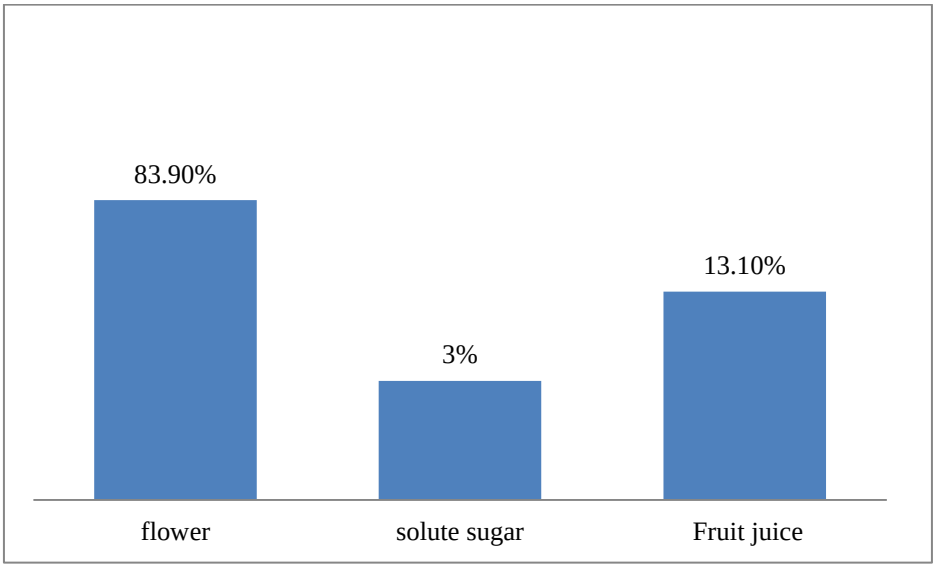

Figure 4.2: Sources of forage for bee colonies

Table 4.4: Major plant species used for honey bee forages and their flowering periods

Vernacular or common name (Afan oromo)	Scientific name	Flowering period	Flowering times in years
Nuggii/ Nug	*Guizotia abyssinica*	Octo-Nev	1

Tufoo	*Guizotia scabra*	Sep-Oct	1
Eebicha/ Grawa	*Vernania spp.*	Jan-March	1
Bakkanniisa	*Croton macrosttachys*	Oct-November	1
Laftoo/ Grar	*Acacia spp.*	April-June	1
Goraa	*Rubu spp.+*	Sept-Oct	1
Atara	*Pisum sativum*	Agu-Sept	1
Baqeela	*Viciafaba*	Agu-Sept	1
Talba	*Linum usitatissimum*	Agu-oct	2
Harbuu	*Ficus sur (F.capensis)*	Sept-Oct	1
Qamaxee	-	Agu-Oct	1
Boqqolloo	*Zea mays*	Octo-Dec	1
Dannisa	*Dombeya aethiopica*	Nevo-Dec	1
Waddeessa	*Cordinan Africana*	July-Sept	1
Bargamoo/Baharzaf	*Eucalptus spp.*	Jan-Febr	1
Qamadii	*Triticum aestivum*	Agu-Sept	1

4.7. **Influence of weather condition on honey bee to produce honey in study area**

In this study area, about 46.6% of respondents stated that honey bees are affected in March-May months, about 24.2% of house hold respondent replied that honeybee affected in June-August months, about 15.8% of the respondent honey bee is affected in December-February months and also about 13.4% of the honeybee affected in September-November as the result got from house hold respondent. This implies that, the production of honey by honey bee is vary from month to month because of the variation of environmental condition from season to season. In this study area, during September-November honey bees are abundant

Table 4.5: Influences of Weather condition on honeybee

Item	Seasonal variation	Frequency	Percentage
	March-May	156	46.6
The effects of weather	June-August	81	24.2
Condition on honeybee	December-February	53	15.8
	September-November	45	13.4

4.8. **Effects of pests and predators on honeybee for honey production in study area**

About 47.5% of house hold respondent replied that most pest influence on honey production are ant, about 22.8% of respondent answered honeybee affected by beetle, about 18.2 % of the respondent were honeybee influenced by birds, about 6.6% of house hold respondent honey bee affected by wasps and also about 4.9% of household respondents were honey production influenced by lizard.

Table 4.6 The effects of pest on honeybee and production of honey

Variable		Frequency	Percent
The influence of pest on honeybee	Ant	159	47.5
	Beetle	76	22.8
	Bird	61	18.2
	Wasp	22	6.6
	Lizard	17	4.9

4.9. Opportunities for honey production in the study area

According to the respondents, the major opportunities for bee keeping in Dire Enchini district selected kebele include: existence and abundance of honeybee, availability of potential flowering plants, ample sources of water for bees, Indigenous beekeepers knowledge and experience and practices, socio-economic value of honey and Youth potential.

Table 4.7 Opportunities identified by respondent to honey production in the study area.

Opportunity	Frequency	percent (%)
Abundance of honey bee colonies	96	28.7
Availability of potential flowering plant	81	24.2
Water availability	67	20
Indigenous beekeepers knowledge & experience	47	14
Socio economic value	25	7.5
Young people potential	19	5.6

4.10. Challenges of honey production in the study areas

The major problems of honey production in the study areas were pest and predator, honey production practicing by traditional method, environmental condition, poor marketing infrastructure, disease, application of chemicals and storage facilities. Each beekeeper involved in the study was requested to prioritize the challenges mentioned earlier. Accordingly, pest and predators, honey production practice by traditional method and lack of beekeeping equipment were found to be the top three challenges for

beekeeping in the study area. These problems may lead to poor quality of honey production. Because of lack of knowledge on application of chemicals against ants, sometimes farmers complained their honey bees are being affected.

Table 4.8 Major constraints identified by respondent for honey production in the study districts

Challenge (constraint)	Number of respondent's (frequency)	percent (%)
Pest and predators	76	22.7
Honey production practicing by traditional method	55	16.4
Lack of beekeeping equipment	48	14.3
Application of chemicals	41	12.2
Lack of bee forage associated with deforestation	33	9.8
Market problem	26	7.8
Poor storage facilities	22	6.6
Poor extension service	20	6
Disease	14	4.2
Total	335	100

CHAPTER FIVE

5. DISCUSSION

In this study area, respondents in the age between 31-50 ages are actively participated in honey production. As the result from field survey showed that the farmers in the most productive aged were actively engaged in beekeeping activities. The result of this study is mostly agreed with Haftu Kebede and Gezu Tedese (2014) which stated that the majority age of the beekeepers in the study area ranges between 31 to 50 years (31.6%).

From current data showed that, most of the households respondent (31.9%) in the study area were could not write and read are participate in honey production. Uneducated beekeepers use only indigenous knowledge to produce honey by using honey bee but beekeeping need connectivity of indigenous knowledge with technology to get high productive of honey. As a result showed that, most of the participant replied the cost of transitional and modern beehives are expensive, due to this many people did not participate on honey production activities in this study area.

In this study, 74.7% respondents of the study area were uses traditional beehive for production of honey. Because traditional beehive utilizes accessible, cheap and plentiful local materials for hive construction and related issues very easily. These hives are also constructed using the indigenous knowledge among the beekeepers for honey production. Also as it was stated by Nuru Ahmed (1999) beekeeping is still operating in the old traditional ways implying the need for modernization, low productivity and poor quality of bee products are the major economic impediments for rural beekeepers, Accordingly interviewers' replied that, traditional beehive are easily affected with rain (during rainy season), accident fire and pest and predators.

As the current data explained that most beekeepers got honey bee colony from their own hive itself 81.5%, because of this, there is inadequate forest uses as honeybee colony source. This result disagrees with the result of Haftu Kebede and Gezu Tadesse (2014) reported that most respondents 60.3% replied that they have got their colonies by catching swarms and the rest from their parents and buying. In open-ended question they explain that most of the honey harvesting mechanism is by traditional and farmers harvest honey by using fire at night time and they throw out the bee colonies on the ground and collect the honey. This practice also increases the vulnerability of honey bee by pest and predators.

Moreover, beekeeper in this study area place their beehives on the roof 46%, for the purpose of land save for agriculture and Shortage of finance to make closure area. According to respondents, placing beehive back yard is chosen than the others by producing honey in all agro-ecologies of the study area. However, not in consistent with the result reported by Tesfaye Kebede and Tesfaye Lema (2007) reported that about 97.6% of the respondents in Adami Tulu put their beehive in closure area.

According to the report, about 50.1% of the household's replies were peaks of honey production period in December months and another about 22.1% of the household's respondent were peak honey production in June. Hence, the period of honey harvesting demonstrates unequivocally how the supply corresponds with the flora's blossoming schedule, producing a peak honey supply at particular period and dropping during the dry season which the bee colonies needs extra feeds. According to the information got from focal group discussion of beekeepers household, honeybee prepare honey during the periods of many plants bear the flowers, but honeybee uses their honey as foods for survive at the periods of the absence of flowered flora.

The study revealed that about 64.2 % of the beekeeper in the study district produces honey for the purpose of income but mostly for local market. According to current data obtained from interviewed of respondent honey is important for abdomen pain, healing wound, and also repairing broken bone to drinking mixed with oats (Mata jabo) powder. There was an opportunity for benefit from honey export as result of its large and diverse flora resource for large-scale honey production. The result of this study identified beekeeping practice is very traditional in the districts with very low production of honey. Thus, economically the respondents depend mainly on non-beekeeping activity or house holders observe other sectors. This was agreeing with Tessega Birhanu, (2009) in Bure districts of Amhara region the main purposes of beekeeping were for source of income and home consumption.

In this study area, about 46.6% of house hold respondents, honey bees are affected during March-May months. This study explain that the variability of environmental condition reduce honey production. This means unfavorable weather conditions such as long rain and very humidity can influence honey bee both directly and indirectly (Tadesse Alamu *et al.,* 2014). It directly influences the honeybees foraging and flight activities and also indirectly it influence honeybees through its effects on their resource base (lowest), disease, pests and predator occurrence.

According to the respond of Beekeepers; birds, ants, wasp, lizards, and small hive beetles were identified as the major honeybee pests and predators. As the result got from current (my) data explained that about 47.5% of respondent in honeybee keepers in study area was the problem of honey bees are ants. These results from current data disagree with the result of Firisa Woyessa and Dejene Alemu (2016) reported that 51.7% honey bee influenced by the reason of birds. The amount and problem of those pest and predators are not different with the variation of climatic condition. According to data obtained from beekeepers in the study area, there are different methods to control those pests and predators, such as dusting ash around the area of hive and also destroying the place

where ant live, keeping environmental sanitation (controlling the dung of cattle from an area of hive placement), cleaning bee hive and removing the bird nest around the placements of hive bee.

According to the result from current data explained by focal group discussion, the beekeeper in the distinct are using traditional equipment, burning animal dung , using knife for cutting honey bread from the hive as well as modern equipment(net) and methods for collect honey from the hive. About 47.20%of the households respondent replied that honey production were affected by land use change, so the traditional ways of economic activities in this districts for generating incomes in sailing woods and wood product with lower price of neighboring high lands were affect forest resource that is the source of flora for foraging by honey bees in both wild and domestic honey production.

According to the respondents, the three major opportunities for bee keeping in Dire Enchini district selected kebele include: existence and abundance of honeybee (28.7%), availability of potential flowering plants (.24.2%) and Indigenous beekeepers knowledge and experience.

The major factors affecting honey production in the study areas were pest and predator (22.7%), honey production practice by traditional method (16.4%) and lack of beekeeping equipment (14.4%) were found to be the top three challenges for beekeeping.

CHAPTER SIX

6. CONCLUSION AND RECOMMENDATION

6.1. Conclusion

In conclusions, the study showed that the bee keeping and honey production system in the study area are affected negatively by various factors such as: deforestation, climatic condition, honey bee pests and predator. Majority of the beekeepers, within the research area generate honey for domestic use than for the market .The most widely used type of apiculture practice in the research region is traditional due to the high cost of the improved hives and their accessories. From the results of the study in the districts, mostly male are involved in honey production and the number of female involve in beekeeping is very few due to difficultness of the traditional practices and low attitude of the society towards beekeeping and honey production by female, so awareness creation and assistance is needed to empower women in beekeeping activities. From the study, it was understood that the colony population is decreasing from time to time due to destruction of forest areas for crop cultivation and different constraints particularly using insecticide chemicals such as cypermethrin, spinosad, and chlorantraniliprole, exerts negative effects on the foraging behaviour, locomotive, flight ability, muscle development and structure of honey bees by regulating the expression of specific genes, predators and bee diseases.

From the study, it was understand that major opportunities for bee keeping were existence and abundance of honeybee, availability of potential flowering plants and Indigenous beekeepers knowledge and experience.

6.2.Recommendations

Based on the results of the study, the following recommendation has been recommended.

- Introducing modern beehives that can make households produce more honey for market than home consumptions.
- Awareness creation and assistance is needed to empower women in the beekeeping activity.
- Developing environmental protection to conserve different vegetation that is the flora source of bees for honey production and continuous inspection of apiary area to manage and protect bee's from predators.
- Avoiding using insecticide and pesticide chemicals around apiary area.
- Availing of methods to assist farmers in their beekeeping ventures by credit availability, cooperative formation, input supply and market facilitation should be put in place with value chain approach.

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APPENDICIES

Structured questionnaire prepared to gather data from household participants

Appendix I: Respondent categories

The objective of the questionnaire will be to collect necessary information on the survey of honey production opportunity and challenges. The questionnaire is prepared for sample formed and the questionnaire is distributed for each of them, to collect necessary information for the study.

N.B Give the right answers and gives necessary information for questionnaire please!

Put ‘‘√″ mark on close ended questions and write short answer response/on open ended question.

Date: Day ☐ Month ☐ Year ☐

1. Keble: _____

2. Sex: Male ☐ Female ☐

3. Age: 14-30 ☐ 31-50 ☐ 51-65 ☐ >65_____

4. Educational level

A. Cannot read and writes ☐ B. Reading and writing (adult education) ☐

C. Attend primary school ☐ D. Attended secondary level ☐

E. College diploma ☐ G. First degree holder ☐ H. If other ☐

5. For how long you lived in Dire Echini *district*?

A) 1-5 yrs ☐ B) 5-10 yrs ☐ C) 10-15yrs ☐ D More than 15 yrs ☐ E) if others ☐

6. Marital status A. Married ☐ B. unmarried ☐ C. Divorced ☐ D. others ☐

7. Occupation_____

8. Religion_____

Appendix 2: Survey questionnaires

1. What kinds of hive do you uses for honey bee production?

A traditional ☐ B transitional ☐ C modern ☐

2. If answered question number 1 why you select_____

3 Who assisted you, as you select hive bee you uses for honey production?

A. researcher ☐ B. your colleague ☐ C. indigenous knowledge ☐ D. others ☐

4. Which kinds of hive are more profitable and comfortable for bee? Why?

A. traditional ☐ B. modern ☐ C. transitional ☐ D. others ☐

5. Which kinds of hive more faced with any problem?

A. Traditional ☐ B. Transitional ☐ C. modern ☐

6. Why it faced with a problem? _____

7. What methods to use for more attractive hive to bee is? _____

8. What do you think the cost of modern bee hive is? _____

A. Cheap B. Fair C. Expensive D. Very Expensive

9. What are the benefits you get from honey production?

A. Income ☐ B. Home Consumption ☐ C. To get better Skill ☐ D. Others ☐

10. Where did you keep your honey bee hives?

A. Backyard ☐ B. Under the roof ☐ C. In the house ☐ D. In the closure areas apiary site ☐

11. Do you participate in honey bee production? A. Yes ☐ B. No ☐

12. If yes, questions number 11 fill the following question

a. The place where you participate _____

b. Duration of participation_____

13. What methods to you use for savings of the bee health

A. Environmental sanitation ☐ B. giving food ☐ C. afforestation ☐ D. others ☐

14. Where do you get honey bee colony?

A. forest ☐ B. hive itself ☐ C. from caves ☐ D. migratory honey bee ☐ E. others ☐

15. How did you get honey bee colony? _____

16. What is the major feed source for honey bee? Mention it:

A sugar ☐ B flower ☐ C fruit ☐ D others ☐

17. What is a part of the plants honey bee to use?

A. Tissue of the plant ☐ B. The stem of the plant ☐ C. flower of the plant ☐ D. others ☐

Appendix 3: Focal Group Discussion

1. Lists the plants that used by honey bees

Lists of plants	Specify months in they flowered	Others remark

2. What attitude you have for honeybee production? Mention it._____

3. From the listed months, which ranges of days are appropriate to get best honey?

Seasons	Specify month	Days
Autumn		
Winter		
Spring		
Summer		

4. What is the peak honey production period? From _____to ___Month

Why? _____

5. Is climatic condition influence on honey production in your local area? A. Yes ☐ B. no ☐

a. If yes, question number 5, in which season could be more affecting honey production fill the

Below table

Season	Specify month	Remark
Autumn		
Winter		
Spring		
Summer		

b. How climatic conditions affect honey production? _____

c. In what way the climatic condition influences honey production? Mention it:

_____

d. How did you solve its problem? _____

6. What types of the organism influences on honey bee?

Types of the organism	How they are affected	put in rank	methods to controls

7. What are the major constraints for beekeeping practice in the area? show by (√)

No	Constraints	Answer
1	Lack of modern bee hives	
2	Lack beekeeping materials	
3	Diseases and pest	
4	Reduction of number of honey colonies	
5	Shortage of bee forage	
6	Agrochemicals application	
7	Lack of technical support	
8	Market	
9	Beekeeping skills	
10	Interest	