ADDIS ABABA UNIVERSITY

COLLEGE OF NATURAL AND COMPUTATIONAL SCIENCE

DEPARTMENT OF ZOOLOGICAL SCIENCES

STUDIES ON STATUS OF APICULTURE IN GIDA AYANA DISTRICT, EASTERN WOLLEGA ZONE, OROMIA REGIONAL STATE, ETHIOPIA.

BY

GAROMA BEYENE

A Thesis submitted to the School of Graduate Studies, Addis Ababa University, in Partial fulfillment for the requirements of the Degree of Masters of Science (M.Sc.) in Biology

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Approved by the Examining board:

Research Advisor

Examiner

DECLARATION

This is to certify that this thesis entitled " Studies on Status of Apiculture in Gida Ayana district of Eastern Wollega zone, Oromia regional state, Ethiopia" submitted in partial fulfillment for the requirement of the award of the degree of MSC in biology from Addis Ababa University, College of Natural and Computational Sciences, Department of Zoological Sciences, submitted by Garoma Beyene. The material embodied in this thesis work has not been submitted earlier for award of any degree or diploma to the best of our knowledge and belief.

Name of the student: GAROMA BEYENE signature _____Date_____

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Lists of Abbreviations/ Acronyms

AGP: Agricultural Growth Project

AMDE: Agribusiness and Market Development Extension (project)

BfD-Bees for Development

CACC- Central Agricultural Census Commission

CSA: Central Statistics Authority

DDP- Development Discussion Paper

ECAEPA: Ethiopian Costumes Authority & Export Promotion Agency.

FAO: Food and Agriculture Organization

GADADO: Gida Ayana District Agricultural Development Office

GADRLA & EPO: Gida Ayana District Rural Land Administration & Environmental Protection Office

HBRC: Holeta Bee Research Center

IPMS: Improving Productivity & Market Success

MAAREC: Mid-Atlantic Apiculture Research and Extension Consortium

MOARD: Ministry of Agriculture and Rural Development

NGO: Non-Governmental Organization

SNNPR: South Nation Nationality and People Republic

SPSS: Statistical Package for Social Science

UNEP: United Nation Environment Program me

USAID: United States Agency for International Development.

ABSTRACT

Eastern Wollega zone is one of the Oromia regional state's zones with high potential of honey and bee wax production. This study was initiated and conducted in Gida Ayana district, Eastern Wollega zone, Oromia Regional State, from September to July 2011E.C with main objective of the study was to assess current status of apiculture and challenges in honey production to come up with possible mitigation strategies in the development of honey production in the study area. Gida Ayana district is blessed with natural resources that create favorable conditions to undertake apiculture activities and upraise the district to one of the potential district for apiculture sub-sectors; but the district still could not harvest this existing potential to the required amount. Because of different problems that limit apiculture in honey production activities in the district. In order to address these objectives Questionnaires, interviews and observation methods were used to collect primary data and secondary data. Using a purposive sampling technique, six kebeles were selected purposely depending on variations in agro-ecology (high, mid and lowlands) and honey production potential. About 167 households responded to the questionnaires and some of the apiculturist households and Livestock and fishery development office experts were interviewed. The data were organized according to relevant research question and analyzed quantitative and qualitative by using Microsoft Office excel 2010 software, IBM SPSS Statistics 21 software. The result of the study showed that honey production activity was mainly undertaken by 31-50 age group (73.9%) people in the study area, majority of the apiculturists about (60.8%) attended the primary school, about (20%) of the respondents did not attend formal education in their life but they took informal adult education and they write and read only in minor and about (19.2%) attended secondary school and above. Therefore most of the apiculturists were able to read and write. Education encourages apiculturist's ability to access and use information relevant to honey production activities and creating more attitudes in transforming current status of apiculture to modern hive utility with more credit service and uneducated one limit the effectiveness of the product in modern honey production in the less credit service, again male (100%) on traditional hives where taboos for females climbing of long trees, male (94.6%) and females (5.4%) for modern hives biased to male. From the result of this study the main limiting factors that affect current status of apiculture together in honey production mentioned by respondents were ants, termites, traditional technology with less utility of modern hives, lack of proper management for bees and hives, use of insecticide/herbicide, deforestation, decline of bee colonies, shortage of bee food, improper harvesting time. The limiting factors identified in the study wereda traditional hives, lack of training on honey production, improper placement of hives, lack of support for the apiculturists and plant species poisonous such as white pear (*Apodytes dimidiate), Euphorbia catinifolia, Justica schimperiana, Nicotinia rustica* and *African soapberry (Phytolacca dodecandra)* to bee were also the limiting factors in current status of apiculture of honey production in the district in which use of insecticide/herbicide was the most determinant. To protect the limiting factors in the current status of apiculture the apiculturists use different traditional indigenous knowledge to overcome possibly the problems. It was recommended that apiculturists were able to alleviate the limiting factors in current status of apiculture through training, by using modern hives and modernization techniques of apiculture, properly manage and place bee hives for ease of inspection, planting bee forage, choosing site of apiary far away from or limited with *Apodytes dimidiata* and red flower from the area, conservation of plants and by using the available resource effectively after the finding of the study result.

CHAPTER ONE

1. INTRODUCTION

1.1 Back ground of the study

Honey is the most important primary product of apiculture both from quantitative and economic point of view, and has been used by mankind for many years as a source of medicine, food and for religious and cultural ceremonies (Cartland, 1970; Mcinerney, 1990; Molan, 1999).Honey has been considered by many cultures as a precious and valuable commodity that is used in traditional rituals, healing or as food (Lietaer, 2009). Honey provides sustainable livelihoods to many small scale farmers and other rural and non-rural people (FAO, 2012).

Ethiopia is the leading honey producer in Africa and is one of the top ten producers of honey in the world (USAID, AGP-AMDE, 2012). It is also one of the four largest beeswax producing countries in the world next to China, Mexico and Turkey. In Ethiopia, beeswax is one of the 12 major exportable agricultural products and an estimated one million farmers are engaged in apiculture (MOARD, 2005/06). The country produces about 28,500 tons of honey and 5000 tons of beeswax annually. In Ethiopia Export of honey and beeswax is estimated to contribute an average of 1.6 million USD to the annual national export earnings (ECAEPA, 2006).Despite its long history, apiculture in Ethiopia is still an undeveloped sector of agriculture. The skill and knowledge of honey and beeswax production of Ethiopian farmers is still very traditional.

Apiculture doesn't need large investment (financial), large size of land and complicated technical knowledge. The outcomes of apiculture are real; some of its outcomes include material goods, income, wellbeing and satisfaction (Nicola, 2009). Apiculture encourages rural community livelihoods and helps rural people to become less vulnerable to different problems and reduces the danger that they will fall into crisis. There is a good potential for apiculture development in Ethiopia, due to suitable weather conditions and availability of various natural bee forage resources (IPMS, 2005). Apiculture is especially an attractive business for the landless and the poor, because it needs a relatively small investment and does not have high land requirement.

Honey production as an activity gives great potential for development in almost all African countries. Apiculture does not compete severely for resources with other farm enterprises

(Gentry, 1982; Adjare, 1990; Bradbear, 2004; MAAREC, 2004). Apiculture can also be supplementary to crop production by facilitating pollination (Wilson, 2006). Honey production can raise the livelihoods of many people including rural and urban traders, those who make hives(carpenters), veils, clothing and gloves(tailors) and those who make and sell tools and containers (Nicola,2004:4). Honey is a cash crop, more than 95% of the product is brought to market and some apiculturists are able to earn 5000 to 10000 annually from honey selling only (MOARD, 2003). Rural and Urban people are engaged in the honey production, trading and selling of honey beer (tej). In every town, "tej" production is a big business which generates income (NURU, 2007:139p). Honey has high social and cultural value in Ethiopia. It has different functions in many traditions such as in Marriage, birth and funeral ceremonies.

Honey production and Apiculture contributes to conservation of the natural environment since its environmentally sustainable activity can be integrated with agricultural practices. It would be one of the most important for sustainable development of poor countries (Gibbon, 2001). Apiculture has been widely promoted many countries as a major contributor to rural development as cash income BfD(Bees for Development,2000).Apiculture can also be supplementary to crop production by facilitating pollination (Wilson,2006). Engaging in honey production and apiculture have a wide range of economic contributions , income generation from marketing honey and its by-products (beeswax, royal jelly, pollen, propolis, bee colonies, and bee venom) and the creation of non-gender-biased employment opportunities. Honey is a nutritive food containing various kinds of sugar, protein, free amino acids, trace elements, minerals, vitamins and enzymes with a high caloric content. Its main sugars fructose, glucose and dextrose are absorbed directly into the blood and provide rapid energy.

Apiculture and honey productions are still operating in the old traditional ways and require the need for modernization. Poor quality and low productivity of bee products are the major economic problem for rural apiculturists because of lack of skill to manage their bees and bee products. Most of the rural apiculturists cannot afford to invest in modern apiculture inputs, processing, packaging, and transport their products to market to maximize profit. Different resources are required for honey production activities. These are the bees, plants, skill and

knowledge of the apiculturists, equipment, transport, financial, skill in packaging and marketing (Nicola, 2009).

Ethiopia has a potential in apiculture as good climate condition and huge potential of bee flora that is important to collect nectar (Fichtel and Admassu, 1994). Due to suitable natural environment in West Ethiopia there are large honey bee colonies. Honey has a long history of human consumption, and is most commonly consumed in its unprocessed state (i.e. liquid, crystallized or in the comb). It is taken as medicine, eaten as food, or incorporated as an additive in a variety of food and beverages.

'Tej' is a very popular honey drink in Ethiopia, and honey consuming by people is the famous culture across the country (Gallman and Thomas, 2012).

Honey bees are very important for humans in many aspects. Honey bees play a significant role for living organisms like pollination service, maintenance of ecological diversity, keeping the environment healthy and those people who do not have land for agriculture it is possible to rear bee and harvest bee products easily. The honey harvested has several functions for the apiculturists, society and economy of country. Honey is important as food, as medical care and in many parts of the world honey is used as a medicine to treat variety of diseases (Gichora, 2003).

The major factors that limit honey production in Ethiopia are; lack of knowledge of(rearing bee & keeping of colonies from enemies),traditional way of apiculture, age of the apiculturist, gender of apiculturist, production cost, deforestation, climate change, lack of conservation, land degradation and shortage of food to bees. The other ecological problems that limit honey production are disease, invasive species, parasite and predators include mammals, birds, reptiles, beetles, ants, wasps and flies (Crane, 1990). Hunting of honey without care of bee colonies, search only honey which is present in cave shelter, hollow trunks of tree, deep hole by using fire flame and spray water to bees to kill the bee and harvest honey. Man is the most significant predator to honey bee in Africa (Crane, 1990). Therefore, the study was focused on factors limiting the current status of apiculture in honey production in the west of Oromia regional state, Eastern Wollega zone, Gida Ayana district, in order to mitigate the challenges of honey production and enhance honey production.

1.2 Statement of the problem

Gida Ayana district is blessed with the ideal natural resources such as natural vegetation, water, suitable climatic conditions that create favorable conditions to undertake honey production activities and make the district one of the potential district for apiculture sub-sector; but the district still could not harvest this existing potential to the required amount. Because of different problems that limit the current status of apiculture in honey production activities in the district like, lack of knowledge of honey production, poor management of bees and hives, proper storage and processing, disease, slow in transformation of modern frame hives, deforestation, parasite, invasive species and predators. In the reality, Ejigu et al (2009) pointed out in Amhara region. Oromia region and the study area which was Eastern wollega, Gida Ayana woreda also share these major constrains as that of Amhara in limiting the status of apiculture in Gida Ayana district. As it was stated in DDP (2013-17) honey production activities have two main economic values such that income generation from honey and its byproducts (beeswax, royal jelly, pollen, propolis, bee colonies, and bee venom) and from creating non-gender- biased employment activities. However, in the consequences, Gida Ayana district, there is no available information about the challenges in particular, but traditional beliefs that most of the time females were ignored from this activity. This informed us honey production activities of the community is insignificant. In this connection, the study was to assess the current status of apiculture in honey production in western Oromia regional state, Eastern Wollega Zone, Gida Ayana district.

1.3 Objectives

1.3.1 General objective

The general objective of this thesis was to assess the current status of apiculture in honey production and investigate challenges and opportunities.

1.3.2 Specific objectives

- ✓ To identify the current status of apiculturist activities and their roles in the economic activities of the society.

- ✓ To assess the indigenous knowledge and modern knowledge of the apiculturist in honey production to overcome the problems in the current status of honey production.
- ✓ To identify pest, predators, bee forage, hive type possession and bee colonies that currently influencing the honey bee existing in the study area as well market constraints of the area.
- ✓ To assess challenges and opportunities of apiculture in the study area.

1.4 Research questions

-What is the current status of apiculture in honey production in the study area?

-How currently the household in the study area are engaged in the activities of apiculture in producing honey?

-What are lists of the current influencing factors of honey bees as well market constraints in limiting honey production in the study area?

-Which kind of indigenous knowledge the apiculturists are used to alleviate and overcome the problems in the study area?

1.5 Significance of the study

The study will contribute to the western Oromia regional state of Gida Ayana district by addressing the status of apiculture in honey production in the district. As Gida Ayana district was selected purposely because of the fact that the district is well known for honey production and it has a number of constraints in the process of honey production. This study focus on the current status of apiculture in honey production in the study area; assess the problem faced the apiculturist; identify current problems of honey production activities in the district and indigenous knowledge to control problems and find solution to enhance the honey production activities to increase the role in the livelihood of the community in particular and for the national economy in general. In addition, the information collected during this study will serve as a baseline for other researchers interested to carry out additional studies in this area.

CHAPTER TWO: LITERATURE REVIEW

2.1 Culture and History of Honey production in Africa

Both humans and honey bees originated in Africa, each species migrating out of the continent on several occasions (Whitfield et al. 2006). Early people took honey from hollow trees found in the forest. The first apiculturists were hunters, seeking out wild nests of honeybees, which often were destroyed to the sweet reward called honey. Honey bee originated in Africa and spread into Europe and Asia. European honeybees were introduced into North America in the early 1600's primarily for honey production.

According to Gallmann and Thomas (2012), the honeybee *Apis mellifera* occurs naturally in a great range of habitats and climatic zones across Africa, the Middle East and Europe. Many African societies have traditional skills regarding of apiculture and get benefit from bees. However, this traditional apiculture practice is not evenly distributed among the people. Therefore, in Africa, some farmers are getting advantage from harvesting bee product. In Africa, Apiculture in bee hives is practiced predominantly in Egypt, Kenya, Ethiopia and Tanzania (Hussein, 2000).

2.2 Culture and History of production of honey in Ethiopia

Apiculture is a long-standing practice in the rural communities of Ethiopia and appears as an ancient history of the country (Ayalew, 2004). Ethiopia has a huge natural resource base for honey production and other hive products. Honey production in Ethiopia has a potential to strength the Ethiopian economy, reduce poverty, and conserve forests. Ethiopia has diverse habitat and flora for honeybees (Mohammed et al., 2006).The honey produced in Ethiopia is expected to become a major commodity for acquiring foreign currency to improve the Ethiopian economy. Ethiopia has longer tradition on apiculture than any other country in the world.“ since the 4th century, during the time of king Ezana, Christianity with strong emphasis on nomadic culture had greater contribution for intensive growth of apiculture, because of wax and honey needed for religious ceremonies and for making traditional beverages” (Fitchl and Admassu, 1994). The country already earns an average of 420million ETB (35 million USD) annually from the sale of honey (Gidey & Kibrom, 2010).

In Ethiopia there are two honey collecting seasons: the major one is that carried out from October to November and the secondary one from April to June. However, in addition to these major harvesting periods, there are many small harvesting periods which depend on the types of flowering plants and rainfall patterns in different agro ecologies, which experienced apiculturists and local people easily associate the harvesting season with the botanical origin of honey in their locality.

There are a number of factors that limit honey production in Ethiopia such as climate change, deforestation, and invasive species that reduce their quality of health and longevity (UNEP, 2010). According to Pokhrel (2008), predators, parasites and diseases are some of other factors that affect apiculture, thus reducing honey production. Parasites and diseases also affect apiculture and this will eventually lower production due to the fact that honeybees will be destroyed by lot of diseases, limiting the status of bees making honey. This is attributed to lack of adequate knowledge of management practices needed in apiculture. Honeybees can also be affected when using plants for their nectar that had been treated with a high concentration of pesticides. Apiculturists therefore should control damage on vegetation planted close to the project area, by making use of less concentrated pesticides on such plants or crops (Pokhrel, 2008).

Apiculture is mainly practiced in rural areas. These areas have people who are less educated in agricultural practices due to the fact that they are unable to get funds for their education thus limiting the harvested honey yields (Yahaya and Usman, 2008). When the colony is not well fed, it will leave the area at the same time affect the yield. Apiculturists therefore, introduce sugar syrup in their feeds at least 6 weeks prior to the onset of the first major nectar flow and this may encourage the production of bees that will be at the appropriate age for foraging by the time of the main nectar flow (Gamez et al., 2004). There are five distinct races of honeybees in Ethiopia namely, *Apis mellifera jementica*, *Apis mellifera scutellata*, *Apis mellifera bondasii*, *Apis mellifera monticola* and *Apis mellifera woyi-gambella* (Amsalu et al., 2004). Among those, *Apis mellifera bondasii* is the famous in the country. Ethiopia is one of the homes of *A. mellifera* (Ayelew, 2004).

2.3 Culture and History of Honey production in Oromia

Oromia is the well-known honey and beeswax producer region in Ethiopia, Oromia (contributing 38 % of total production), Amhara (26 %), SNNPR (18%), Tigray (7%) and other regions (11 %) as regional share of honey production according to AAU (2015). The region is a full of natural resource for the activities of honey production; Different species of plants, high bee colonies, good water supply, suitable agro-ecological and climate condition. The resource that important for bee includes dense forest, oil crops, grain crops, different shrubs and herbs. This suitable agro ecology and good climate condition makes high reproduction, well survive of bees and good production of bee product.

Eastern Wollega zone is one of the Oromia regional state's zones with high potential of honey and bees wax production. The livelihoods of Gida Ayana district mainly falls under cereal crop production, livestock production and cash crop production (Coffee and Chat) and honey production. The household livelihoods of the population of the district are based predominantly on crop and Livestock production.

CHAPTER THREE: METHODOLOGY OF THE STUDY

3.1 Description of the study area

The study was conducted in Gida Ayana district, west Oromia national regional state which is found at 442km from Addis Ababa and 112km North from Nekemt. Based on agro ecology the area is classified in to high land (2%), mid land (48%) and low land (50%). Gida Ayana district is located in the range of $09^0\,46'00''$ N latitude, $36^0 38'00''$E longitude and 1500m-2290m altitude range or 2118m altitude from mean sea level. It is boarded by Guto Gida Woreda in the South that tributed by Hangar river gorges, in east Kiremu Woreda and Horo Guduru Wollega Zone, in the North Abay River Gorge border delineate Gojam in Amhara Region and in west Limu Woreda and Ibantu Woreda which separate this Gida Ayana Woreda in Eastern Wollega Zone. Gida Ayana district was selected purposely because of the fact that the district is well known for honey production and it has a number of constraints in the process of honey production.

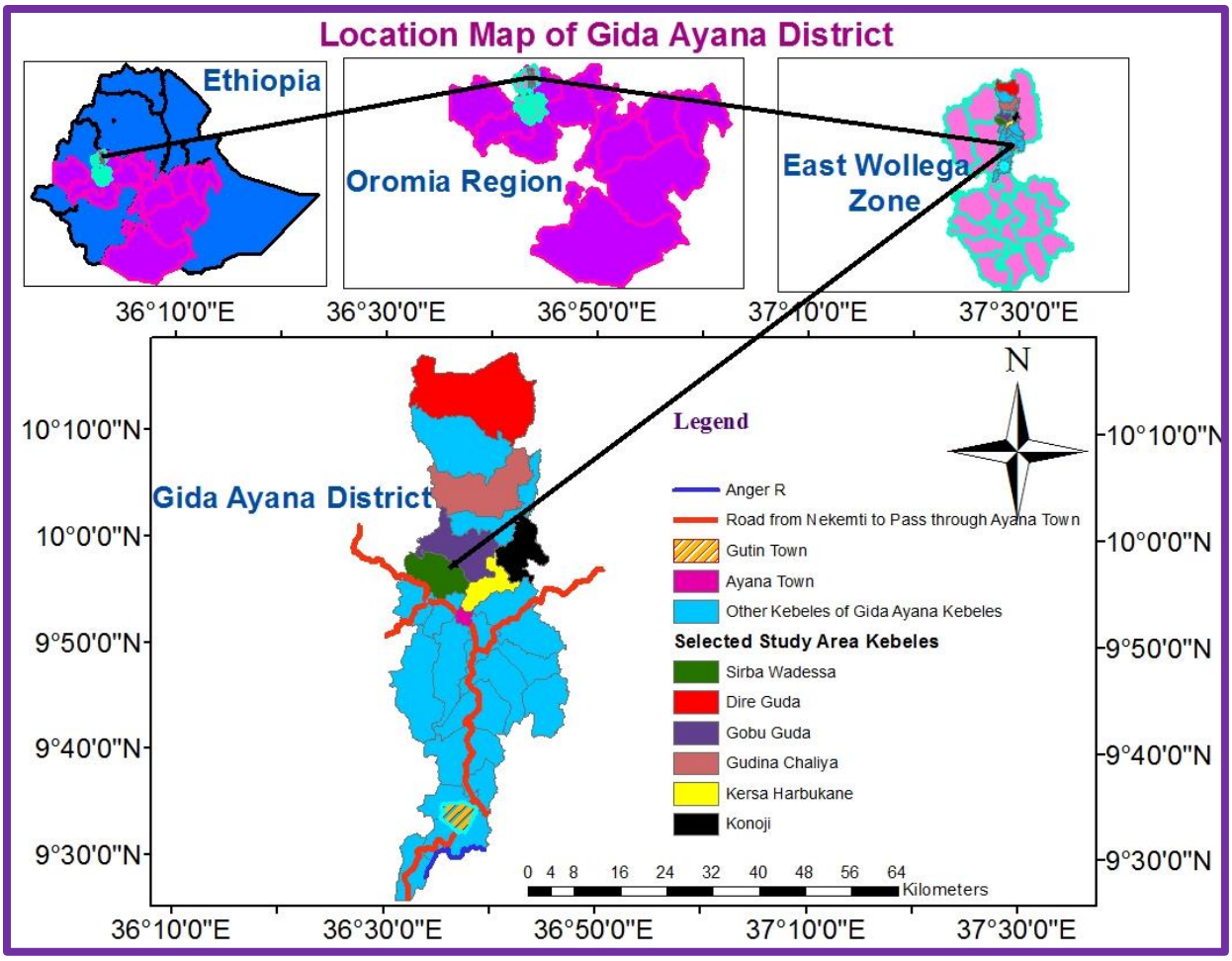

Plate 3.1 Map of Gida Ayana district

3.2 Climate

Climatically Gida Ayana Woreda consists of more than two types of climate. On the basis of traditional climate classification, we have three agro-climatic zones in this district. They are Dega, woina- dega and kolla. As the below table shows, the annual average temperature of Gida Ayana district is about 19.1^{0}c with maximum temperature of 28.6 ^{0}c in March and minimum temperature is about 12.2 ^{0}c in August. Temperature increases as one move from dega (highland), woina-dega (midland) then kola (lowland).

Table 1. Average Temperature distribution in Gida Ayana Woreda per month and per annual (2017-2018)

Year	Mont.	J	F	M	A	M	J	Jl.	A	S	O	N	D	Yearly Av.
2017	Mont.Max (^{0}C)	27.9	27.3	28.6	26.8	24.7	23.9	21.7	21.9	23.3	24.2	24.9	25.0	25.0
	Mont.Min (^{0}C)	11.6	13.4	15.4	14.6	14.1	13.6	15.9	11.2	13.1	13.5	12.8	12.7	13.5
2018	Mont.Max (^{0}C)	25.5	27.9	28.5	26.5	26.6	22.9	21.8	21.9	24.0	24.5	25.0	25.1	25.0
	Mont.Min (^{0}C)	11.8	14.2	13.7	16.5	13.3	12.6	11.6	13.1	12.7	13.0	12.3	12.6	13.1
2017-2018	Ann.Max. Av (^{0}C)	26.7	27.6	28.6	26.7	25.7	23.4	21.8	21.9	23.7	24.4	25.0	25.1	25.1
	Ann.Min. Av. (^{0}C)	11.7	13.8	14.6	15.6	13.7	13.1	13.8	12.2	12.9	13.3	12.6	12.7	13.3
	Ann.Av. (^{0}C)	19.2	20.7	21.6	21.2	19.7	18.3	17.8	17.1	18.3	18.9	18.8	18.	19.1

Source: - Gida Ayana Woreda Meteorology Station (2018)

Table 2. Average Rainfall distribution in Gida Ayana Woreda per month and per annual (2017-2018)

Year	Month	J	F	M	A	M	J	Jl.	A	S	O	N	D	Total
2017	R.F.(mm)	0.0	86.4	39.7	113.3	259.3	191.0	259.1	198.9	256.6	74.6	24.9	0.0	1503.8
2018	R.F.(mm)	0.0	3.8	10.9	31.8	118.5	219.3	225.3	216.9	136.0	72.3	23.0	0.0	1057.8
2017 - 2018	Average R.F.(mm)	0.0	45.1	25.3	72.6	188.9	205.2	242.2	207.9	196.3	73.5	24.0	0.0	1281.0

Source: - Gida Ayana Woreda Meteorology Station (2018)

As the above table indicates, total annual rainfall in Gida Ayana Woreda is about 1,281.0mm and it decreases based on geographical variation. The maximum rainfall is 242.2mm in July and minimum is 0.0mm in December and January, while no or very minimum precipitation in November and February because those months are dry season even in many parts of the country. Generally, both temperature and rainfall distribution is depend up on the geographical variation in elevation.

3.3 Demography of the district

This Woreda is divided into 28 Kebeles of which 21 of them are settled by peasants engaging their livelihood by the means of agriculture and 5 urban center of which one urban center, Ayana Town of Gida Ayana Woreda serving as Capital Town and center of administration. Based on a population and housing census of 2007 GC, the total population of this Woreda was about 187,432 with the composition of 97798(52%) of male and 89634(48%) of female population of 86% local and 24% urban residents. The total area of this Woreda is about 183,063.73 hectare sharing 13% of the total area of Eastern Wollega Zone (Gida Ayana district rural land administration and Agricultural Development Office, 2018). In district, different nations and nationalities are found, Oromo is the majority, and Afan Oromo is the official language. The local people are mainly engaged in growing crops, animal husbandry and apiculture. In the

district, there is huge potential of natural resources such as fertile soil, dense forest, huge bee colonies, coffee, and waterfalls that can attract tourists (Gida Ayana district rural land administration and environmental protection office, 2018).

Even if it is not well known, tourist attraction sites in this Woreda is also playing some role for the economic development and improvement of livelihood of the population of Gida Ayana Woreda. Some of the tourist sites of this Woreda are Mt. Mayu, Tirigni (Forest Site); Mt. Nefuro,Mt. Injiro and Sob-chaliya spring ('Gada' Festive Site); Kucho Mountain (Twin Stone);Hora Walaja Mineral Water and others can be mentioned (Gida Ayana Woreda Culture and Tourism Office, 2018).Regarding religion 82% of the societies of the district are followers of Orthodox and protestant,16% of Islam and 2% of 'Wakefata' means followers of traditional religion who never follows nor rejects those religions mentioned above. One can simply conclude that as Christen religion dominates this Woreda and that of the study area based on the percentage of followers (Gida Ayana Woreda Administration and Government Communication Office, 2018).

3.4 Study design and sampling techniques

For this study, a cross-sectional research design was used to describe the apiculturist's general characteristics and to assess current status of apiculture. The information was collected then organized and analyzed accordingly. Gida Ayana district comprised of 28 rural kebeles and five administrative towns. From which six kebeles were selected from 28 rural kebeles as sample depending on variation in agro-ecology and honey production potential. The samples of the study were apiculture farmers of each six kebeles. To select individual household apiculture farmers, simple random sampling by lottery method was used to avoid personal bias and to give equal chance for the respondents to be included in sample size. The study population was the apiculturist in the district (Table 3). The purposive sampling method was used. Because this method was mainly essential to get valuable information since these kebeles were the sub district identified well known of both traditional and modern apiculture. The sampling units were household apiculture farmers of six selected kebeles and the sample frame of this study was the list of household apiculture farmers of six selected kebeles in the district.The 167 sample size of the apiculturists from six kebeles were selected from total household apiculturists of six selected kebeles of 288, using Yemane (1967) sampling procedure. Information and the study used about

status of apiculture in honey production, the purpose of honey production, type of hives used, the number of bee colonies owned, and other hive products, the rate of harvesting and processing of hive products were collected through data collection instrument such as a semi-structured questionnaire, interview and observation.

3.5 Sample size selection

The sample size was determined by (Yemane) 1967 sampling formula with 95 percent confidence level. This formula was used to calculate the sample size from total population of the apiculturist farmers of six kebeles. To select sample size the following mathematical formula was used;

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

Where;

n =represents the sample size;

N= designates total number of households (apiculturists)

e =represents maximum variability or margin of error 5 %(0.05)

1=designates the probability of the event occurring

In this study the total numbers of apiculturist households are: 288 and the sample size were calculated by the above formula.

$$n = \frac{N}{1+N(e^2)} = \frac{288}{1+288(0.05^2)} = 167$$

To select sample size from each kebele the following mathematical formula was used:

$$ni = \frac{n \times Ni}{N}$$

N=total apiculturists of selected six kebeles
Ni=total apiculturists of each kebele
n=total sample size of selected six kebeles
ni =sample size selected from each kebele

Table 3. Distribution of apiculturist households in each kebele

Study area	Name of kebele	Number of apiculturist households in each kebele			Number of sample respondent house hold in each kebele		
		Male	Female	Total	Male	Female	Total
Gida Ayana district	KERSA HARBUKENE	51	9	60	32	3	35
	SIRBA WEDESA	38	17	55	26	6	32
	GOBU GUDA	59	1	60	35	0	35
	KONEJI	57	3	60	35	0	35
	GUDINA CHALIYA	31	1	32	18	0	18
	DIRE GUDA	21	0	21	12	0	12
Total	Six	257	31	288	158	9	167

(Source: Gida Ayana district livestock and fishery development office, 2018)

3.6 Data collection

Data were collected from primary and secondary sources in order to achieve the objectives of the study and answer research questions (Table 4). Primary data were collected through questionnaires and interviews from sample respondents who engaged in apiculture activities and the district Livestock and Fishery development experts, in the district. The questionnaire was prepared in English language first and translated in to Afan Oromo language. Interviewing some of the apiculturists and Livestock experts were needed because some of the apiculturists may not read and write to fill the questionnaires. Secondary data mainly from document review of concerned office like climate, demography and other valuable unpublished reports from Gida Ayana district rural land administration and environmental protection office (GADRLA & EPO) and Gida Ayana district Agricultural development office (GADADO).

For this study, secondary data were, from document review such as internet, journals and research findings. Visual observation was also part of data collection. The primary data collected from the respondents were focused on General characteristics of household such as sex, marital status, educational status, age, Involvement in apiculture activities, Custom on apiculture practices and honey production potential and suitability with types of bee hives possessed by apiculturists, Current status of Apiculture with different types of Hives and their associated honey bee colony, productivity and popularity of usage of honey, Sources of honeybee colony,

placement and types of hives, Management of honey bee colony in inspecting apiary sites and during honey harvested, Honeybee colony holdings and hive types, Trends of honey production, Status of material and support given, Amount of honey they harvested per-year, Constraints of current status of honey production, Indigenous knowledge in alleviating constraints of current status of apiculture preventive measure taken by apiculturists, Change in current status of honey bee flora resources, Presence or absence of plants species toxic to bees, using semi-structured questionnaires.

Table 4. Total number of sample respondents

No	Respondents	Method of data collection	Total number of respondents
1	Apiculturists	Questionnaires and Interviews	167
2	Gida Ayana district livestock and fishery development expert narrated on status of apiculture	Interviews, storytelling, giving report accounted	3
3	Other apiculturists narrated on status of apiculture	Interviews, story telling	5
	Total		175

3.7 Data analysis method

The data were collected then analyzed and interpreted by qualitative (descriptive and report method) and quantitative (percentage, frequency, tabulation and ratio) method using Microsoft excel 2010 software and IBM SPSS Statistics 21 software. In general, questionnaires were analyzed through tables (frequency and percentage) to compare results. Open-ended questions including interview and observations were analyzed using descriptive methods.

CHAPTER FOUR: RESULTS

4.1. General characteristics of the sampled household Apiculturist Respondents in Gida Ayana District

4.1.1 Sex, Age and Educational status of household Apiculturist Heads

The age, sex and educational status of sampled household apiculturists were shown in Table 5.The age of the respondents range from 15 to 70 years with the mean of 42.5 years. The majority of the apiculturists were below 50 years old (88.1%) and about 11.9% of the respondents were above 50 years old. The sampled household apiculturists were male biased such that about 94.6% were males and 5.4% were females. Implying that in the study area honey production was dominated by male and women were not encouraged to be involved in honey production business. Regarding educational status of the apiculturists about 20% did not attend the school and about apiculturist households who did attend and got a chance to go to school education were attending primary school, Secondary school and Above education with the proportion of 60.8%, 16.7% and 4%, respectively. Moreover, for illiterate people there is a need of intensive training and persuading of apiculturists before distributing movable frame hives. The distribution and possession of Traditional, Transitional and Frame hives were different based on this apiculturist house hold characteristics as observation and count of each type of bee hives of sample respondent indicated. The possession of both Transitional and Framed hives were not gender biased, as 5.4% females were only involved in both Transitional and framed hives possession, but traditional hives were gender biased with no female was involved in traditional way of apiculture from the result of the study. Moreover, age group in productive age was engaged in apiculture activities in the study area, as 73.95% accounted for age group of 31-50 years which were more involvement in apiculture practices.

Table 5: Age, sex and educational status of household Apiculturist Heads

Age Group		Sex				Educational status		
In Year	In%tage	Male		Female		Category described	Number of respondent (frequency)	In %tage
		Frequency	In %tage	Frequency	In %tage			
15-30	14.2	158	94.6	9	5.4	Illiterate	33	20.0
31-50	73.9					Primary school	101	60.8
Above 50	11.9					Secondary school	29	16.7
Total	100					Above	4	2.5
						Total	167	100

4.1.2 Purpose of Apiculture and Involvement of sample respondents in Apiculture activities

According to the results of this survey, reasons for involvement of the farmer respondents in apiculture were income generation activities as ease to perform with other agricultural activities, together with large family size and limited farm land size in hectare that necessitated as other means of income to alleviate poverty incompatible to these factors.

Thus one could expect the situation where people are actively engaged from an early age in helping older apiculturists to undertake basic tasks. Based on their exposure, young people gradually move on becoming independent apiculturists as soon as they can obtain their own hives. They were accumulating their experience by seeking technical advice from fellow apiculturists whenever necessary according to Chala Kinati et al. 2013. In this purpose the apiculturists generating income that meets urgent financial need, dietary requirements, transport, loan repayment, dowry and gift, fuel, fertilizer, used as a buffer in the case of crop failure, and also for social and cultural functions. As finding of the study indicated that resource poor farmers are also participating mostly in apiculture due owning of less hectares of land with large number of family size with this resources in competition.

4.2 Respondents Custom on Apiculture Practices and Honey Production Potential and Suitability with types of bee hives possessed by apiculturists in Gida Ayana District

Apiculture Practice in Gida Ayana: Apiculture in Gida Ayana district has been practiced as sideways with other agricultural activities. Based on the study, there were no any respondents who base their livelihood only this sector. By depending on their level of economic status, interest by sexes and educational status attitude, three types of bee hives have used by the sample apiculturist farmers in the study area. These were traditional (28.5%) only and moveable frame (modern) bee hives (71.5%) who did have modern hives in addition to traditional hives being ownership respectively (Table 6).But, with smaller percentage of modern hives possession per respondent apiculturist household relatively.

Traditional Custom of Apiculture: The sample respondents have greater number of traditional hives with bee colonies only (18.7%) per respondent apiculturist household (Table 6), because they have easily constructed from locally available materials such as clay pot, woven grasses. The productivities of one fixed comb hive (Traditional hives) were 2 to 7 kg /hive (Table 12) that harvested 1 to 2 or 3 times per year depending on honey bee flora, but the honey production is not that much compared to other apiculture system.

Custom of Frame hive and Top Bar Hive Apiculture: Based on the study, the only problem or constructing top-bar hive (TBH) by apiculturists were inabilities keeping the specific size of top-bars and for the sake of transition to familiarize and overcome resistance to framed hives through increased honey production. Due to this problem the framed hive distribution was very low (2%), (Table 6). However, the productivity is greater on average (35.7 kg /respondent /yr.) than the fixed comb hives (the Traditional hives) (4.4kg/respondent/yr.) which were next to moveable frame hives (14.6kg/respondent/yr.) (Table 12) on page 33. From the modern hives, Top-bar hive proved to be the most appropriate because of its low cost and the fact that the apiculturists or local carpenters can easily construct it.

Modern apiculture hive (Framed) consists of precisely made rectangular box hives supering one above the other and increase as bee population increase by bee swarming and otherwise decreases if not bee and swarming were properly managed, in this study result which was slightly greater possession (3.3%) than Transitional hives (2%) (Table 6) and likewise

(Kerealem, 2008) but it requires high investment cost and trained man power. According to the respondent's response, the productivity of honey from the framed hive is good that honey harvesting ranging from 26.5 to 45 kg per hive (Table 12).

Table 6: Potential for honey production and types of hives used in Gida Ayana district

Observation and interview	Item	Number of respondents(n=167)	Percentage
Potential of honey production by apiculturist of the study area was.	High	149	89.2
	Low	3	1.7
	Medium	15	9.1
	Total	167	100
Observation for additional possession and identification of modern hives (Transition and Framed) possessed when interviewed inclusively.	Those have modern hives in addition	119	71.5
	Those didn't have modern hives	48	28.5
	Total	167	100
Types of hives Apiculturists used through interview with bee colonies were in mixed possession or not inclusively or exclusively.	Traditional only	31	18.7
	Transitional only	4	2
	Modern only	5	3.3
	Both Traditional & Modern	55	32.7
	Transitional & Modern	5	3.3
	Traditional, Transitional & Modern	67	40
	Total	167	100

4.2.1 Current Status of Apiculture with different types of Hives and their associated Honey bee colony, Productivity and Popularity of Usage of Honey in Gida Ayana District

In order to utilize apiculture sub-sector, identifying the current status of apiculture with different types of Hives and their associated Honey bee colony, Productivity and Popularity of usage of honey and searching for solutions of mitigating paramount importance in the study area. The current status of apiculture with all its unalleviated challenges was solved at once because of capital and skill shortage of apiculturists in the study area. As a result prioritization of constraints the current status of apiculture and why the apiculture was undeveloped and still very traditional in Gida Ayana.

Based on the result of the study, honey bee colony, productivity and usage of hives were suffered from a number of challenges that are antagonistic to the success of desired in honey production through apiculture. Major challenges in apiculture in the study area arise from environmental factors that are associated with bee characteristics and are beyond complete control of the apiculturists although they tried to treat the challenge, while others have to do with traditional hives predominate that are more exposed to challenges of absconding and reduction of honey bee colony that resulted in decrease in productivity and was not matched with increased popularity of usage of honey as poor marketing infrastructure and storage of facilities undermine honey cost discourage both apiculturists and timely increase in popular utility as medicine, eaten as food, or incorporated as an additive in a variety of food and beverages.

Generally, modern hives and modern equipment in apiculture than traditional hives were demanding in order to lessening wax in crude honey product ease of extracting for pure honey compared to framed hives' honey, not to resulted in poor supply of pure honey in contrary to increased demand of popular utility of honey in the study area that not much attracted interest of market chain beyond of the study area. Moreover, the majority of apiculturists lack of protective close, smoker, casting mold and honey extractors, without which improved apiculture practices and more extraction of table honey can't be successful, since these all were in poor supply to the demand of the apiculturists according to the survey of the study area. Besides, apiculture equipment is expensive relative to the purchasing power of apiculturists and knowledge gap in using them. Therefore, the adoption of improved apiculture practices also relies on the supply of these basic inputs that were being tempting the study area's current status of apiculture that seek solution to intensify provision of more modern hives that enhance honey bee colony, productivity in quality and quantity of honey and popular utility of honey by beneficiaries and market chain for the apiculturists in the study area which were inter-related income based.

Despite the mentioned constraints in the current status of apiculture in the study area, there is still huge potential to increase honey production and to improve the livelihood of apiculturists in the district. Beside the existing natural resource, no stakeholder has recently put in its agenda in the need to develop apiculture as one of the strategies to reduce poverty to diversify national exports. Even though, NGO's like IPMS (2005) are also giving more attention to the sub-sector than ever before as an important intervention to support the poor and particularly the women.

This will give Gida Ayana district farmers the opportunity to access improved technologies and capacity building (training on apiculture). Honey and wax processors and exporter which have formed associations and apiculturists in the districts started to establish cooperatives/unions. These institutional changes will give a good opportunity to create increasing demanded on honey and cooperative market in the region and to promote export, which will in turn result in endogenous technological change and overall development in the sub-sector for the district.

4.2.2 Sources of honeybee colony, Placement of Hives and Types of Hives

Sources of honey bee colonies as foundation for apiculturists primarily based on Self-interest of bees that means without apiculturists interventions (58.5%), whereas about 3.4%, 2.8% and 26.1% of the respondents said that their foundation of honeybee colonies were catching bee swarms, getting bee colony through gift from parents, through inheritance when swarmed respectively and the other respondents were used **mixed** sources figured as follow being 1.2% , 5.1%,1.7% and 1.2% which were through self-interest of bees & getting bee colony through gift from parents, both self-interest of bees & through inheritance; catching bee swarms, getting bee colony through gift from parents & through inheritance; and self-interest of bees, catching bee swarms, getting bee colony through gift from parents & through inheritance respectively (Table 7) which still have influence on the current status of apiculture in the study area to slow down progression.

Table 7. Sources of honeybee colonies in the study area.

Sources of honeybee colony	% of respondents
1.Self-interest of bees	58.5
2. Catching bee swarms	3.4
3. Getting bee colony through gift from parents	2.8
4.Through inheritance	26.1
5.Self-interest of bees & Getting bee colony through gift from parents	1.2
6.Both Self-interest of bees & Through inheritance	5.1
7.Catching bee swarms, Getting bee colony through gift from parents & Through inheritance	1.7
8.Self-interest of bees, Catching bee swarms, Getting bee colony through gift from parents & Through inheritance	1.2
Total (N= 167)	**100**

Regarding placement of hives, the majority of the respondents (41.92%) placed their hives on Backyard in open space on long trees & Backyard under shelter made for this purpose (25.6%) , while the other **mixed** placement area 0.6%, 1.1%,16%,5.1%,0.6%,17.6%,13.6%,15.9%,2.8% and 1.1% of the respondents placed their hives on Backyard in open space, Backyard in open space on long trees, Backyard under shelter made for this purpose, On forest trees far away from residence area, Backyard in open space & Backyard in open space on long trees, Backyard in open space on long trees & On forest trees, Backyard under shelter made for this purpose & On forest trees far away from residence area, Backyard in open space on long trees, Backyard under shelter made for this purpose & On forest trees far away from residence area, The first four placement area and Other places including the first four placement area respectively (Table 8). Majority of the respondents placed their hives on back yards with little number of improved framed hives which were not completely replaced traditional hives for ease of close supervision of honey bees and traditional hives involved in all placement mentioned above which was mainly being placed On forest trees far away from residence area which were not easily supervised and inspected.

Table 8: The Placement of types of hives in Gida Ayana district

Where do you keep your hives? Through invitation of observation and count the number in kind of hives.	Number of respondents touched n=167	% tage	Placement with hive types			
			Traditional	Transitional	Movable frame	Total Hive types that served(possessed) by respondents
Backyard in open space	1	0.6	✓	✓		2
Backyard in open space on long trees	2	1.1	✓			1
Backyard under shelter made for this purpose	27	16	✓	✓	✓	3
On forest trees far away from residence area	8	5.1	✓			1
Backyard in open space & Backyard in open space on long trees	1	0.6	✓	✓		2
Backyard in open space on long trees & Backyard under shelter made for this purpose	43	25.6	✓	✓	✓	3
Backyard in open space on long trees & On forest trees far away from residence area	29	17.6	✓			1
Backyard under shelter made for this purpose & On forest trees far away from residence area	23	13.6	✓	✓	✓	3
Backyard in open space on long trees, Backyard under shelter made for this purpose & On forest trees far away from residence area	26	15.9	✓	✓	✓	3
The first four placement area	5	2.8	✓	✓	✓	3
Other places including the first four placement area	2	1.1	✓	✓	✓	3
Total	167	100	1	0.64	0.55	Proportion of placement involved

Plate 4.2.2 (a, b, c & d) demonstrated the different types of hives and their placement in the district. Accordingly, traditional hives placed on all mentioned placement areas, Backyard in open space, Backyard in open space on long trees, Backyard under shelter made for this purpose

and On forest trees far away from residence area; transitional hives placed on Backyard in open space and Backyard under shelter made for this purpose; whereas modern hives placed only on Backyard under shelter made for this purpose were some of the practices observed in the district.

Plate 4.2.2 (a) 8 Traditional hives on long trees in the forest far away from residences

Plate 4.2.2 (b) 12 Traditional hives on long trees at Backyard in open space

Plate 4.2.2 (c) 14 Modern hives on back yard under simple shelter made for this purpose

Plate 4.2.2 (d) 14 Modern hives under tree shelter near apiculturist eave of backyard

4.2.3 Management of honey bee colony in inspecting Apiary sites and during Honey Harvested

Internal hive inspection was conducted by farmers practicing improved apiculture and undertaken during honey harvesting; swarming seasons, and when there was suspicion of bee pests like wax moths in which the infested frame was removed by and the like to safeguard the colony (49.8%), (Table 9). External hive inspection were conducted to assess the status of honey bee colonies and to check the neatness the apiary was (50.2%), (Table 9). Kebede (2007) and

Lemma (2008) reported that internal hive inspection of traditional hive is not easy and common due to inconvenience of the hive design. Similarly, Kidane, 2014 reported that the inappropriateness of traditional hive for internal inspection make the management of reproductive swarming impracticable. Inspection of hives and apiary is indispensable to safeguard honeybee colonies from different natural disasters and various hazards (pests, diseases and chemical poisoning), respondent apiculturists believe in that visiting the apiary and the hive externally or internally during rainy season causes diseases, why some external inspectors (purposive) and all internal inspectors were aware that case. For this reason, during rainy seasons the apiary is covered with grasses which may intern serve as a hiding place of pests of honey bees.

Experiences show that external colony inspection can be done at any season, however, caution is required in what season and at what frequency the internal inspection should be conducted. In this regard, training apiculture farmers is essential which was not developed and still very traditional and challenge current status of apiculture in honey production in quality and quantity as internal inspection were not possible with traditional hives that were practiced more than the modern hive types in the study area.

Table 9: Managements of honey bee colony, Apiary visit and Hive inspection

Items	Description	Frequency	Percent
External hive inspection for honey bees whether purposive or not.	Yes purposive	27	16.2
	Not intentional	57	34
Inspection frequency of colonized hive Apiary sites for inside Hives management category as needed caution was.	Daily	-	-
	Once a month/weekly	12	7.2
	Accidental	32	19.2
	Only during harvesting	39	23.4
	Total	167	100

4.2.4 Honeybee colony holdings and Hive Types

The average honey bee colony of the sample respondents for traditional, top bar and moveable frame hives were 35, 2, 2 respectively from 37,3,2 average traditional, transitional and modern hives possessed per respondent of the district respectively (Table 10). These show that modern hives possessed more honey bee colony than the rest traditional and transitional hives depending on the management of honey bees like super- imposing additional boxes, swarming and

additional provision of food and water during drought seasons be ease in modern hives than the others, even the situation was more possible in transitional hives than traditional hives.

Regarding availability of honey bee colony from time to time with more respondents (68.4%) increase (Table 10) due dynamic increase in utility of both modern and transitional hives per respondent even though small in number compared to the number of traditional hives they possessed in the district that enhance more management of honey bee that prolong life availability of honey bee in the hives reducing absconding and maintaining honey bee colony, but not still to the extent needed and was backward in status of apiculture in the study area.

Table 10: Dynamic Reason in honey bee colony holdings with their Hive Type Management

Items	Descriptions	Frequency			Percent
Availability of honey bee colony from time to time	Increase	67			68.4
	Decrease	12			12.2
	Constant	19			19.4
	Total	167			100
Income from honey production from time to time as cost of selling in the same market place	Increase	151			87.5
	Decrease	9			5.1
	Constant	7			7.4
	Total	167			100
Types of hives used by apiculture respondents observed from their apiary site while interviewing them	Types of hives possessed by respondents in kind exclusively counted.	fere que ncy of resp ond ents per year	Total types of hives posse ssed by n=16 7 per year	Averag e Types of Hives possess ed per respond ent per year	% tage of respondents from hive types possessed with honey bee colonies per year
	Traditional	75	2,775	37	95
	Transitional	47	141	3	3
	Modern hives	45	90	2	2
	Total	167	3,006	42	100
Average honey bee colony holding with regarding hive types.	Traditional	75	2,625	35	95
	Transitional	47	94	2	3
	Modern hives	45	90	2	2
	Total	167	2,809	39	100

4.3 Trends of Honey Production in Gida Ayana District

Respondents agreed that 42% in traditional only, 66% in top bar in addition to transition hives and 52.5% modern hives in addition to traditional hives, but the trend of honey bee production during the period of 2001-2010 E.C (2009-2018 G.C) has reduced for any one of multitude reasons, even though the apiculturists possessed more inclusive hive types. This agrees with the results of Kerealem (2005). The sample of respondents indicated for reasons for decreasing trend of bee products as application of chemicals (pesticide/herbicide) (67%) shortage of enough types of bee forage and water availability (16%), pests and predators (16%) shortage of availability of honey bee colonies, drought that manifested by the distributions of rain in seasons of rain, poor attention of government and poor attention of non-government. The latter two, poor attention of government and non-government regarding provision of material supports and absence of adopted policy in apiculture (1%).

On the other hand, 34.0%, 33.3% and 39.0% in traditional, transitional and modern hives respectively of the respondents has replied that the trends of bee products in a given years have increased respectively. These respondents assumed the increased trend of bee products to be getting additional colonies by super imposing, adoption of improved apiculture practices and afforestation program particularly with coffee plantations comprising of more management. On the other hand, 22.6%, 66.7% and 5.1% in traditional, transitional and modern hive respectively of the respondents perceived the trend to be constant.

From this we can conclude that in Gida Ayana district honey bee products production was in a decreasing trend due to shortage of bee forages, winter drought, shortage of honey bee colonies and poor attention of governments and non-governments in their order of importance comparing the two, decreasing and increasing treatment factors though both were changes in the study area.

All the above factors with the decreasing trends of honey bee products in these year ranges associated with absconding and migration of honey bee colonies which were more recorded in traditional hives that decreasing the asset of honey bee products from the study ‘woreda’.Insufficient provision of transitional and modern frame hives that caused lack of maintaining and control reproductive swarming by the help of additional super- imposing (supering) was currently facilitating these problems. On another way for the low

absconding/migration rate of colonies from modern hives may be due to honey and brood comb left for bees during honey harvesting time and ease of timely supervision and inspection and safeguard both the hives and their bee colonies which were more proposed and interested hives in the trend . In addition to these the types of trees from which modern hives made were played role for less absconding of bee colonies as they choose such as 'Tid' and 'Warka' for their better taste and smell to bees, hence knowing this interest of bees and constructing modern hives from 'Tid' and 'Warka' were wise way of lessening absconding/migration rate of bee colonies and help in prolonged life of bee colonies in modern framed hives provided that enough bee forage and protected enemies of bee colony in the study area.

4.3.1 Respondents Response in status of Material and Support given

Table 11 demonstrated that about 38.6% of respondents did not take any kind of training and material provision for the construction of their hives but were private by themselves, while 11.9%**,**0.6%,2.3%,14.2%,1.7%,2.3%,21%,2.9% and 4.5% respondents somewhat from Government, DA & Non-governmental organization (NGO's), DA & Private, Non-governmental organization (NGO's) & Private; DA, governmental organization & Non-governmental organization (NGO's); DA, governmental organization & Private; DA, Non-governmental organization (NGO's) & Private; Government, Non-governmental organization (NGO's) & Private; DA, governmental organization, Non-governmental organization (NGO's) & Private respectively were took training and material provision for progression of their apiculture owned were supported in **mixed** stake holder manner (Table 11). Privately constructing hives made the apiculturists pushed to more traditional system of apiculture that retarded honey production in the current status of apiculture in the study area.

Table11. Material supports provided for hive construction and honey production

Material provided by	% tage of respondents	Frequency
Government	11.9	21
Private	38.6	62
DA & Non-governmental organization (NGO's)	0.6	1
DA & Private	2.3	4
Non-governmental organization (NGO's) & Private	14.2	25
DA, governmental organization & Non-governmental organization (NGO's)	1.7	3
DA, governmental organization & Private	2.3	4
DA, Non-governmental organization (NGO's) & Private	21	34
Government, Non-governmental organization (NGO's) & Private	2.9	5
DA, governmental organization, Non-governmental organization (NGO's) & Private	4.5	8
Total	100	167

Plate 4.3.1(a) Transitional Hives Support by Self Construction

Plate 4.3.1(b) Transitional Hives Support given by DA

4.3.2 Apiculturist Households Response on amount of Honey they Harvested Per-year

The amount of honey produced from one bee hive per year varies from places to places, which in most cases is determined by the existences of plenty pollen and nectar source plants, usage of different types of hives and the level of management and input. The maximum amount of honey harvested from traditional, top bar and frame hives were 7 kg, 20 kg and 45 kg respectively and the minimum records from all three types of hives in the study area were 2kg, 9.3kg and 26.5kg. (Table 12). These results were indicators of the existence of room for increasing performances of these beehives through good management practices coupled with favorable apiculture environment. This also notes us what we are still below the line of productivities what apiculture industry can perform. Based on the results of the current study, the average amount of honey harvested from traditional, top bar and frame hive were 4.45kg, 14.6kg and 35.7kg per hive per respondent per year respectively (Table 12). The honey value obtained from traditional hive is lower than the national average yield (5kg) and the result reported by Workneh et al. (2007) that stated the average amount of honey harvested per traditional hive in West, South west North Shewa zones to be 6.2kg.

The sample respondents reported to harvest their honey in one distinct harvesting seasons which is the major and the most known to all apiculturists, that is , from November to December and April to June peak harvesting period. Based on the results of this study, in the district purposely

once a year or potentially twice a year. According to CACC (2003) report the average frequency of production for all three type of hives used in Oromia region were once and ranged from one to two. Hence, the period honey harvesting clearly shows that the supply follows the flowering pattern of the flora which results in peak supply of honey during specific period and dropping during the dry seasons during which the bee colonies require extra feed. Which was similar with the result of Tessega Belie (2009) in Burie district and Chala Kinati et al. (2013) in Goma district, time of peak honey harvesting is from November to December.

Table 12: Respondents average crude honey production per hive per year

Average total hives possessed and honey produced, maximum and minimum honey produced in different types of hives per respondent per hive per year respectively	Types of hives used	Respondents		Average hives possessed per respondent/yr.	Total honey produced in (kg) per respondent/yr.	Average honey produced per hive in(kg)/respondent/yr.	Maximum in (kg)/hive/respondent/yr.	Minimum in (kg)/hive/respondent/yr.
		Frequency	In %tage					
	Traditional	75	95	35	154	4.4	7	2
	Transitional	47	3	2	29.2	14.6	20	9.3
	Modern hives	45	2	2	71.4	35.7	45	26.5
	Total	167	100	39				

Majority of the respondents (54%) harvested below 100 kg of crude honey per year, while 29%, 11.4%, 2.8%, 1.7% and 1.1% of the respondents harvested 101-200kg, 201-300kg, 301-400kg, 401-500kg and 1.1% above 600kg of crude honey per year, respectively (Table 13).

Table 13: Response on amount of honey the apiculturists harvested per year

Amount of crude honey the apiculturists harvested per year in(kg)	Number of respondents n=167	Percentage
≤100	90	54
101-200	48	29
201-300	19	11.4
301-400	5	2.8
401-500	3	1.7
501-600	0	-
Above 600	2	1.1
Total	167	100

Regarding honey processing and marketing in the case of studying area, majority of the farmer apiculturists did not process honey before sales (Plate 4.3.2). They sold their honey as crude honey which had been stored in plastic sack, tin/barrel, clay/log pot, guard pot, and plastic containers. Because the majority of the apiculturists used traditional hives with no access to modern equipment. But, in comparison to this few apiculturists adopted basic processing practice to chunk the comb honey (Plate 4.3.3) mainly honey comb from modern hive in to liquid mixture of honey compressing the sack with their foot or hand, direct heat and sunlight their crude honey, and using modern equipment available to them (Plate 4.3.4). Comparison of crude honey from traditional hive (Plate 4.3.2) to that of modern hives (Plate 4.3.3) with regard of honey and wax content, traditional hive contained more wax to honey ratio than modern hive which contained less wax to honey ratio. Because of this modern hives were more productive in honey than traditional hives. The above (Table 13) only compares the crude honey in Gida Ayana district.

Plate 4.3.2 Sampled Honey produced in Gida Ayana from Traditional Hives as crude with more Bee wax.

Plate 4.3.3 More Honey produced from Modern Hives as crude with less significant Bee wax

Plate 4.3.4 Comparison of Honey produced from Traditional hives on the Left side and Modern Hives on Right side in Gida Ayana District.

4.4 Response on Constraints of Current Status of Honey Production in Gida Ayana District

According to the result from respondents survey, the major constraints that hinder apiculture sub sector in Gida Ayana district indicated in (Table 14) below.

Table 14: Major constraints of apiculture in Gida Ayana district ordered in their rank

Constraints	Rank	Percentage (%)
Application of chemicals(pesticide/herbicide)	1	67% (111)
Pest and predator	2	16% (27)
Shortage of bee forage	3	11% (18)
Lack of rain fall	4	5% (9)
Absence of policy in Apiculture	5	1% (2)
Others	6	0% (0)

Application of Chemicals: Application of chemicals such as fungicides, pesticides and herbicides affected the productivity and production of honey bee colonies. According to the respondents (67%) ranked first constraint in the district. Therefore, focus should be given to those chemicals, which are not harm full to honey bees and the application should not match with flowering seasons to minimize the poisoning effect on honey bee.

The Prevalence of Pest and Predators: The prevalence of pests and predator**s** are interesting with life of bees. According to(Brad Bear, B., 2002) ants, honey badgers, bee- eater birds, wax moth, spiders, termites , snakes cause devastating damage to honey bee colonies and products within a short period of time. According to the respondents (16%) ranked second constraint in the district next to chemical application (Table 14) in challenging the current status of apiculture in the study area and were listed in(Table 15).

Table 15: Major Pests and Predators identified, Seasons of incidence and Types of damage caused by them that limit honey production in Gida Ayana district.

Pests and predators that limit honey production		Seasons of incidence	The influence	Types of damage given by sample respondents were in below column			
				Honey bee	Bee brood	Hive	Bee product
ANTS (*Formicidae*)		Year round	Causes migration of bees from the hive, Eats the bee product	✓	✓		✓
BIRDS(bee-eater bird) (*Merops ornatus*)		April-July	These birds feed honeybee & decrease bee colonies.	✓			
SPIDERS (*Araneae*)		Year round	Make the web around hives and catch the bee and eat	✓ .			
HONEYBADGERS (*Mellivora capensis*)		June-September	Eat the honey, Causes destruction of hives.		✓	✓	✓
TERMITES (*Isoptera*)		Year round	Destruct the hives and hive stand.			✓	
SNAKE(*serpentes*)		Year round	Polluting the honey and disturb the bees				
WAX MOTH *(Galleria mellonella*)		May-September	Eat and destroy the bees' wax.		✓		
Other lists	LIZARD (*Lacertilia*)		Eat the bee product				✓
	SMALL HIVE BEETLE (*Aethina tumida*)	Year round	Damage combs and comb content, disturb the bees, feeds honey				✓
	Red ant	Year round	Eat the bee product				✓
	MONKEYS	Year round	Destruct the hives, Eat the honey.			✓	✓
	Shrew(small mammal)	Year round	Destruct the hives, Eat the honey.	.		✓	✓

Shortage of Bee Forage and Rainfall: Shortage of bee forage leads to a devastating problem according to respondents (11%) ranked third that hinders the production and the productivity of honey bee colonies especially during dearth period when not matched to weather data in Table 1 and Table 2 on annual average temperature and total annual rainfall in consecutive years of 2017 and 2018 which were conducive with bee biology and bee products even though rainfall increasing with elevation and vice versa for temperature based on geographical variation. This constraint was highly associated with insufficient availability and lack of rain fall based on climatic variation with less yield in 'cola' than 'dega' and 'woina dega' according to respondents (5%) ranked fourth constraint in the district following to chemical application and the prevalence of pest and predators (Table 14). So, the apiculturists should apply the below problem solving techniques that were taken as the measurement to control the effect of lack of rainfall. Based on the response of Apiculturist and available information it has a series problem particularly during the winter season, which results poor plant performance. Therefore, in this regard the apiculturist has to provide supplementary feed to his or her colony, plant drought resistance bee forage around their apiary and provide water.

None devoted Apiculture Policy: The life stock sector not only in and around Gida Ayana but also in Ethiopia has probably has suffered more than crops and crop sectors from inappropriate government policies and the apiculture sub sector is no exception. Based on the study the respondents (1%) ranked fifth constraint in the district. So to improve and sustain apiculture sector the government should give special attention to it.

Along with the identifications, apiculturists of the area have a serious concern and have various practices in controlling the above and other pests.

Scarcity of Apiculture Equipment: Another constraint as the study in respondents interviewed indicated was that the level of apiculture is still traditional and has various limitations. Introductions of improved apiculture technology to rural communities are beyond the power of them and not easily available for these who can afford it. Most of local apiculturists lack of basic tools such as bee veil, hand gloves, smokers and others (Edessa Negera, 2002).

4.5 Response on Indigenous Knowledge in Alleviating Constraints of Honey Production

Pest and predator Preventive measure taken by Apiculturists

Table 16: Pest and predator Constraints of Honey Production and Preventive measure taken by Apiculturists

Constraints	Preventive measure taken by Apiculturists
Ants	Clear apiary, place fresh ash and urea fertilizer around the base of a hive Stand, plastering hive stand with mood spraying garlic juice, malathion and hot Water, burning the ants with fire, destroying ants' nests, uses white eucalyptus leaves as repellant, plastering of thin rubber sheets and metals between the hive and hive stands, pour used engine oil around the hive and keeping weeds Well away from the base of the hive stand.
Birds	Putting something (cloth, festal-plastics) and spin around the hive and, killing using 'wonchif'.
Spiders	Clean apiary, removal of spider's webs and killing.
Honey badger	Use spin, killing, fencing and killing.
Termites	By destroying termite nest, killing termite queen.
Snakes	Clean apiary, smoking with plant material and killing.
Wax moth	Clean apiary, remove old comb, and strengthen the colony, fumigation With cotton cloth and sorghum bran, rubbing with recommended plant materails like *vernonia amygdalina*, spraying garlic juice

Plate 4.5 The hive stands covered by smooth iron sheet materials to prevent ants and small mammals from honeybee.

4.6 Change in Current Status of Honey bee flora resources

The honeybee plants in all watersheds of the study area include trees, shrubs, herbs, and cultivated crops. All the participants of the respondent perceived that the availability of honeybee floral resources decreased in the past ten years. This result of the study agreed with Asaminew Tassew (2015) who reported the decrease in honeybee flora for the past ten year in the Northwestern of Ethiopia accounted by all the participants.

Honey bees store honey for their own consumption during dearth period. Apiculturists are harvesting honey, which the honey bees stored for themselves. As a result, honey bees face starvation due lack of feed. To overcome the problem, supplementary feed is required for the honey bees. The supplementary feeds include *beso, shiro,* sugar syrups, honey and water mixture

and peepers mostly for the backyard placed hives that mainly to enable close supervision of colonies than forest hanged traditional hives that might have been for the sake of more accessibility of bee forages.

All these supplementary feeds provided that the change in the current status of honey bee flora resources. In addition to supplementary feeding planting bee forage such as coffee is also required to get the intended honey yield. Bee forage determines the amount of honey yield obtained. The existence of more bees forages results in high honey production provided that other factors are suitable for honey production. Even though change in the current status of honey bee flora resources in the study area, some of the lists of honey bee flora in the study area were listed in appendix 8.4 as lists of some honey bee floras in Gida Ayana district.

Honey bees collect water from stream, rivers, and the rest from springs, ponds, water thanks, standing pipes and from other available sources. Honey bees use large quantities of water to dilute their broods' food and to cool hives by evaporation during dry seasons. If suitable drinking water is available in the immediate surroundings within 500 m from the apiary, provision of water is not required. In many literatures, water is mentioned as equally important as bee forage to the honey bees (Jones, 1999; Paterson, 2006). Honey bees elapse most of their time in collecting water for major purpose of rinsing the collected nectar and keeping the micro-climate of their hives.

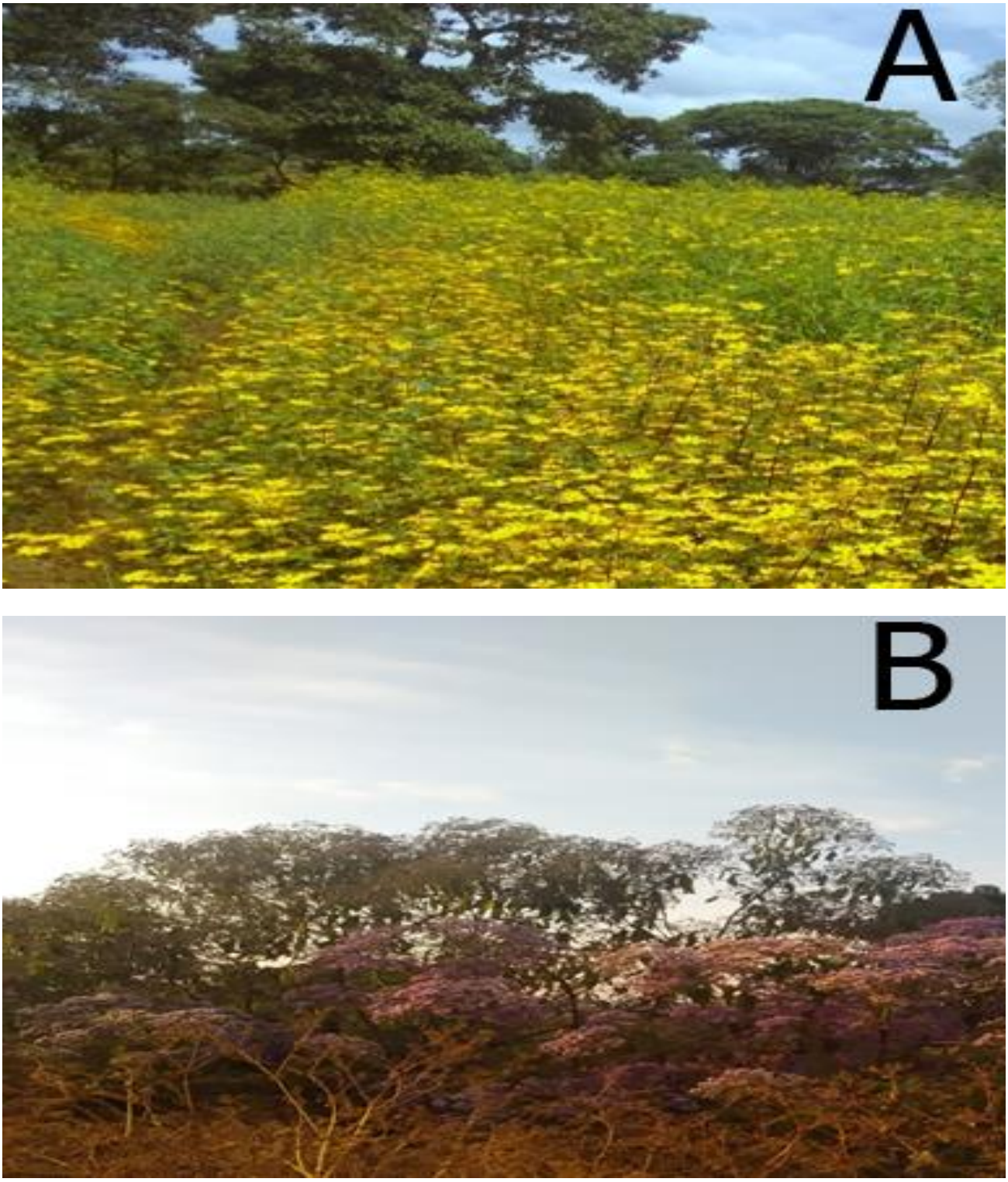

Plate 4.6 Honey bee flora in Gida Ayana district such as *Guizotia abyyssinica (A)* & *Vernonia auriculifera (B)*

4.6.1 Plants Species Toxic to Bees

Plate 4.6.1 Plants Species Toxic to Honey bee in Gida Ayana district is Donga (*Apodytes dimidiata*)

Table 17: Species of Plants those are Toxic to Bees and Bee Product

Scientific name	**Number of respondents n=100**	**Family**	**Local name (Afan Oromo)**
Apodytes dimidiate	80%	Metteniusaceae	Dongii
Euphorbia catinifolia	9 %	Euphorbiaceae	Abaaboodiimaa
Justica schimperiana	5%	Acanthaceae	Dhummuugaa
Nicotinia rustica	4%	Solanaceae	Tamboo
Phytolacca dodecandra	2%	Phytolacaceae	Handoodee(endod)

CHAPTER FIVE

5. Discussion

Honey has high social, cultural and economic values in Ethiopia. It has different functions in many traditions such as during marriage, birth and funeral ceremonies. According to Gidey and Mekonen (2010), honey and bees wax also play a big role in cultural and religious life of the people of Ethiopia. Honey has been used to generate income, as well as for nutritional and medicinal value for local communities (Benjamin & McCallum, 2008).

To achieve the objectives of the study, 167 samples of household apiculturists were selected for collecting of data for honey production. By random sampling techniques to avoid personal bias and to give equal chance for the respondents to be included in the sample. About 167 apiculturists were from total household apiculturists of six selected kebeles of 288 using Yemane (1967) sampling formula.

The age of the apiculturist is very essential to determine the type of agricultural activities engaged by the apiculturists. The mean ages of the respondents were 42.5 years. The range was 15 to 70 years. The report showed that majority of apiculturists in the study area were productive and active age group and more likely energetic in holding their honey production than the old age groups. Out of the total respondents, 88.1% of the respondents were below 50 years old and 11.9% were above 50 years old. This result agreed with the finding of Melaku (2005) who reported that the age groups between 15-60 were considered as economically active age group. Similarly, Chala (2010) reported that the most productive age group were actively involved being supported by experienced from elder and finally become independent apiculturists. The current findings also demonstrated that the sampled household apiculturists were male biased such that about 94.6% were males and 5.4% were females. Implying that in the study area honey production was dominated by male and women were not encouraged to be involved in honey production business, since the district was more relayed on the traditional method and the traditional method requires climbing of long tree to hang hives. It was a cultural taboo for a female to climb a tree in some kebeles found in the study area. This result agreed with Hartmann (2004) who reported that in Ethiopia traditionally honey production was men's job. Such gender biased practice kept the productivity low.

Education is important to utilize improved honey production technology, for fast transfer of knowledge and to increase production and productivity. Regarding educational status of the apiculturists about 20% did not attend the school and about those respondent households who did attend and got a chance to go to school education were grouped into primary school, Secondary school and Above education with the proportion of 60.8%, 16.7% and 4%, respectively. As most of the apiculturists were able to read and write education encourages apiculturists ability to access and use information relevant to honey production such as modern apiculture, while uneducated individual do not access such information. Lack of education has negative impact in utilization and adoption of improved honey production technology. Education and training barriers brought about sticking to tradition practices by neglecting modern practice, which ultimately lead to low production of and productivities (Ajiao and Olajimeji, 2013).Similarly, Workneh (2011) reported that education increases the access to information and thereby raising knowledge of apiculturists regarding improved hives. The Dabessa and Belay (2015) reported similar literacy problem from walmara district such that about 42.9% of the apiculturist cannot read and write which is in agreement with the current finding. Tessega (2009) reported different scenario from Burie district such that most apiculturists cannot read and write. Regarding suitableness of the district, all the respondents disclosed that Gida Ayana district has suitable conditions for honey production because of its huge dense forest, large honey colonies, availability of food and water for the bees and suitable environmental conditions among others. Presence of dense forest incase availability of nectar and pollen for honey bee and the water is important for honey bee consumption as well as brood rearing and hive ventilation. In addition to this, bee colonies and suitable environments are the base for honey production. This study agree with Nuru (2002) who reported that the availability of more honey bee forage results in high honey yield provided that other factors mentioned in the body of the result are also suitable for honey production.

Based on their level of technological advancement, three types of bee hives were used by the sampled apiculturist farmers in the district. These were traditional, transitional and improved modern frame bee hives. The result of the study showed that traditional hive was the leading (18.7%) as individual hive type possession exclusively whereas the mixed three types of hives possession inclusively which were traditional, transitional and modern hives were the leading (40%) from the mixed hives possession and about 2%, 3.3% were exclusively transitional,

modern; 32.7% and 3.3% were inclusively both traditional and modern, transitional and modern, respectively with more coverage traditional hives despite the fact that the respondent's ownership of the three hive types inclusively. With no respondents used both traditional and transitional hives inclusively together. The result showed that majority of the apiculturists were used traditional hives, because it's easy to construct, it's cost effectiveness and less dependency on external input and also because of expensiveness and unavailability of modern hives and accessories. This finding agrees with Nuru (2007) who reported that, lack of management practices and poor placement of the hives the average annual honey yield per colony is relatively low. Similarly Tessega (2009) who reported that most of the apiculturists placed their honey bee colony at back yard and inside the house. Training is the back bone of apiculturists to know how to operate modern honey production technology and to develop skill and knowledge of the apiculturists. Training can bridge technical gaps and equip the apiculturists with basic knowledge how to operate improved hives and bee equipment, basic bee biology and honey bee colonies. Regarding training given to apiculturists, majority of the respondents (85.8%) did not take any kind of training. It is only about (14.2%) of the respondents got training. The report indicated that majority of the apiculturists did not get any training on honey production and management. This means that the district Livestock and Fishery Development office has not given an attention for expansion of modern honey production method and apiculture industry.

Different factors endanger the life and products of honeybee in the study area, from this the existence of pests and agrochemicals were the major challenges to honey bees and their products. With respect to problem faced the apiculturists, almost all apiculturists faced honey production problems. They listed out pests like ants, beetles, spiders, honey badgers, birds, lizards, red ants and monkeys. This result agreed with Desalegn (2001) who reported that Ethiopia is one of the sub-tropical countries where the land is not only favorable for bees but also for different kind of honey bee pest and predators that are interacting with the life of honey bees.

The result of the study indicated that, there were a number of challenges that limit the current status of apiculture and reduced honey produced in the study area. From these the major challenge factors were; impacts of application of agrochemicals, pest and predator, shortage of bee forage, lack of rain fall and absence of policy in apiculture with the proportion of 67%, 16%, 11%, 5% and 1%, respectively. Other limiting factors were such as decline of bee colonies,

improper harvesting time, monkey and shrew (small mammals), respectively. From the pests, ants and termites were very serious problems in the study area. Insect pests were the primary factors that limit honey production, because they may cause total migration of bees from hives. This finding agreed with Kerealem (2005), who reported that ants, honey badger, bee- eater birds, wax moth, spider and beetles were the most harmful pests and predators for bees and their products. Similarly, Workneh (2011) reported the existence of these pests in Atsbi-wombetra district which is in agreement with current findings. Similar result was reported by Desalegn (2001), in which ants were found to be the first ranked pest in his study area. As information was gathered from all the respondents deforestation was carried out for different purposes in the study area like; for farmland, construction, charcoal and timber making. This implies shortage of bee food was directly related with deforestation. This finding agreed with, Tessega (2009); Haftu and Gezu (2014) who reported that the shortage of bee forages, drought, pesticides and other herbicides application, lack of water, decreasing in number of bee colony, lack of improved beehives and poor management as reasons for products and honey bee population decline.

The woreda farmers are producing mainly, teff, wheat, barely, nug, chick pea, groundnut and different horticultural crops. They use of chemical spray such as pesticides and other herbicides for pests and weed controlling have two disadvantages. Herbicide chemical destroys bee forage like herbs and shrubs, which are used as sources of pollen and nectar. The use of pesticide for protection of tsetse fly and mosquito directly kill honey bees and herbicides not toxic to bee colonies but destroy many plants that are valuable to bees as sources of pollen and nectar. Examples of these chemicals; Sevin, melathion, DDT, 2-4D and acetone. Some of the apiculturists totally lost their bee colonies due to these agrochemicals (Kerealem et al., 2009). The apiculturists said that a number of bee colonies either died or absconded from their hives due to extensive use of agrochemicals in the district. This result agreed with Nuru (2007) who reported that agrochemicals and deforestation reduced the number of honey bee colonies, which resulted in low honey production. To overcome these problems the apiculturists used far from apiary sites. As the apiculturists said that, they did not properly know the time of harvesting honey and they detected harvesting time by smelling and by observing concentration of honey bee colonies around beehives entrance and the defensiveness of honey bee, which decline the economy of apiculturists.

Poor access to material and technical support was the factors that cause great challenge to apiculturists who adopted improved honey production practices. Regarding support given to the apiculturists, majority of the respondents (88.1%) did not obtain any support from the government to overcome some of the current limiting factors in honey production, but about 11.9% of the apiculturists had support from the government. About 38.6% of respondents did not take any kind of training and material provision for the construction of their hives were only private by themselves, while 0.6%,2.3%,14.2%,1.7%,2.3%,21%,2.9% and 4.5% respondents somewhat respectively were took training and material provision were in mixed manner. Lack of apiculture material and financial support from the government for the apiculturists had its own impact on quantity and quality of honey produced. This result agreed with Haftu and Gezu (2014) who reported farmers did not have any type of improved apiculture equipment in Hadya zone.

The result of the study showed that, majority of the respondents (54%) harvested below 100kg of honey per year, while 29%, 11.4%, 2.8%, 1.7% and 1.1% of the respondents harvested 101-200kg, 201-300kg, 301-400kg.401-500kg and 1.1% above 600kg of crude honey per year, respectively. This implies majority of the apiculturists did not harvest enough amount of honey in the study area because they used traditional technology and due to impact of agrochemical and pests. This result agreed with Nuru (1999) who reported that low product and low quality of honey were the major economic impediments for the apiculturists. The respondent also said, 2-7kg, 9.3-20kg and 26-45kg of honey were harvested from traditional, transitional and modern beehives respectively based on availability of bee forage. However, they relayed more on traditional hives, which lead to low quantity and quality of honey. Similar finding was reported by Beyene and Verschuur (2014) in which 5kg, 10kg and 16kg of honey was harvested from traditional, transitional and modern hive, respectively in Wonchi district shewa zone.

The result of study indicated that different varieties of pests were found in the study area, which challenge honeybee and reduce their products. Among these; ants (*Formicidae*), beetle (*Aethana tumida*), wax moth (*Galleria mellonella*), honey badger (*Mellivora capensis*), spider (*Araneae*), lizards (*Lacertilia*), termite (*isopteran*), birds (*Merops ornatus*), monkey and snake (*serpents*) were major constraints for productivity of honey. Ants, beetles, termites and wax moth significantly effect on honey yield since they highly limit the activities of bees or cause

absconding. Honey badger –this nocturnal animal break hives at night and consume honey, bee-eater bird-this bird stay around apiary site and catch and eat the bee, termite-destroy the hives and hive stand. In general honey insect pests were the major bottle necked to apiculture sub-sector and causing significance economic loss in honeybees and their product. This result agreed with the report of (Kerealem, 2005), ants, honey badger, bee-eater birds, wax moth, spider and beetles were the most harm full pests and predators in order to decreasing importance of apiculture in Amhara region. To mitigate the problems, the apiculturists had different methods of controlling the pests that limit honey production in the study area. These were clearing around apiary site, clearing the hives, using white ash as repellents of ants and moving honeybee colonies from spraying area. This finding agreed with Gidey and Mekonen (2010) reported that traditionally, farmers have their own control means of pests including the application of ash, rope around entrance of hives (hanging the predator's neck) and using insect repellents.

Honey bee can be poisoned by poisonous plants and agrochemicals. As the result of the study showed that the toxic plants nectar and pollen found around the study area were; *Apodytes dimidiata*, *Euphorbia catinifolia*, *Justica shimperiana*, *Nicotinia rustica* and *phytolacca dodecandra* with the proportion of 80%, 9%, 5%, 4%, 2% respectively. Apiculture respondents reported that the white color flower plant called *Apodytes dimidiata* and the red color flower plant called *Euphorbia catinifolia* were highly expanded in the study area kill worker bee during flowering stage. This decline the number of bee colonies and their product. This finding agreed with Nuru (2002) reported that some poisonous bee plants from northern regions of Ethiopia, and pollen grains of nine poisonous species of bee plants from the families of "Acanthaceae, Euphorbiaceae, Phytolacaceae, Solanaceae, Ranunculaceae and Plantaginaceae" were the major flowering plants that affect honey bee and reduce their product. Similar result was reported by Kerealem (2005) in which pollen or nectar of poisonous plants was toxic to bees and those in which the honey produced from their nectar are toxic to humans.

CHAPTER SIX: CONCLUSION AND RECOMMENDATION

6.1 Conclusion

Gida Ayana district has adequate natural resources and a long tradition of honey production favorably matched to weather data in Table 1 and Table 2 on annual average temperature and total annual rainfall in consecutive years of 2017 and 2018 which were conducive with bee biology and bee products. However, the district and the rural apiculturists in general did not fully benefited from this apiculture sub-sector. Because they used more traditional method, lack of training, lack of material and technical support from concerned bodies that did not match demand and supply.

The finding revealed the current status of apiculture in honey production in the study area. These were characteristics of household apiculturists such as gender, age and educational status which brought imbalance of practicing and utility of different types of hives with the purpose of involvement for urgent income generation, paying loan and purchasing commodities for large family size sustainable life and small farm land possession as self-employment and gender biased but unfortunately all apiculturists were not equally benefited from this sub-sector due skill gap ,difference in attitude and constraints encountered their activities and productivities in apiculture as the major challenge influencing the current status of apiculture in the study area such as possession of more traditional hives than modern hives which were low in honey production, offer unease swarming management of bee source and more source of bee was being self-interest of bees which was not controlled than other sources which were more ease for management and then was being constraint to slow transition to modern hives which were more productive that made still traditional with less technology, hive itself and harvesting equipment that lessen the quality and quantity of honey production and lessen access to market cost that in turn were not motivating the apiculturists for more progress.

In addition to these, material provision to the apiculturists were mostly by self-effort of apiculturists than government and non-governmental organization due shortage in providing training and support and practiced side ways to other agricultural activities that did not elaborate apiculture activities by surplus manner and great attention as well infrequent supervision and inspection associated with most of bee hives which are traditional placement far away from

backyard caused less management and treatment of honey bees that resulted in absconding, decline of bee colonies, and less production of honey than naturally expected. The study showed that majority of the rural apiculturists engaged in traditional method, because it is easy to construct, cost effectiveness than the modern beehives, which is very expensive lack of proper management for bees and hives. Furthermore, as the finding of the study shows constraints like Application of chemicals(pesticide/herbicide), insects and predator such as ants, beetles, wax moths, spiders, termites, honey badgers, shrews and lizards, small mammals and monkeys were challenged honey production activities by consuming the honey and killing the bee colonies , Shortage of bee forage due deforestation of bee flora resources such as *Guizotia abyyssinica* and *Vernonia auriculifera* and the like were deep rooted, Lack of rain fall , Absence of policy in Apiculture which were ranked first, second, third, fourth and fifth respectively and bee poisonous plant species such as *Apodytes dimidiate*, *Euphorbia catinifolia* , *Justica schimperiana* , *Nicotinia rustica* and *Phytolacca dodecandra* in order of effect challenging the current status of apiculture in the study area.

To mitigate the current challenges, the apiculturists used their own indigenous knowledge to minimize some of the limiting factors by different mechanisms like clearing around apiary site, placing white ash around hive stand, providing supplementary food and water for bee and avoiding agro-chemicals around apiary site. However, the method was not effective to alleviate the problems totally from the study area.

The survey study also showed modern and transitional beehives give more honey production for example up to the maximum of 45kg per modern beehives depending on agro-ecology and management of bees in the bee hives than traditional bee hives which is small in size and not suitable for better management of bees as a means if well used in progressive than traditional by substituting it in more maintain honey production in the study area.

Despite all the limiting factors and challenges were being status of apiculture currently facing the apiculturists in the study area, there are still opportunities and potential to the production system and quality of hive products. Like suitable climate, availability of bee flora, huge number of bee colonies and water availability.

6.2 Recommendation

Based on the result of this study, it is recommended, therefore, to increase production, productivity and to improve the economy of the apiculturists the following recommendations can be given:

1. The apiculturists in Gida Ayana should transform the culture of Traditional hives to modern hives to properly exploit adequate natural resources in the district and better management of apiary area.

2. The females have to properly involved and equally participated in apiculture as this sector is not to be a gender biased, all age groups should involve and training and support have to be given attention by district Livestock and Fishery Development Office and NGO's to upgrade skills, awareness in transforming modern hives that make invite all sided characteristics of the apiculturists to reduce poverty.

3. Self-employment should be emphasized as purpose for involvement in raising revenue of large family size and small farm land possession to alleviate poverty by apiculture sub-sector that accommodated more modern hives than traditional hives that increase the economy of the country as well.

4. The placement for hives should be back yard for ease of supervision and management that greatly allow the adoption of transforming the custom of apiculture in to modern hives that again elaborate source of bees through inheritance than self-interest of bees that are cost- effective and progressive in increasing the colony of honey bees for better productivity in quality and quantity of honey.

5 The district Live Stock Office and NGO's should increase the provision of materials from modern hives to all processing equipment as well as encouraging apiculturists for better quality and quantity of honey production that enhance more price in market together in facilitating chain and access to market.

6. The apiculturists would use the biological method instead of chemical that affect at apiary site, clearing hives' area and planting bee forage to alleviate currently increasing deforestation,

provide supplementary food during winter and drought period alleviate deforestation and shortage of bee forage.

7. Indigenous knowledge of apiculturist should be in supported by scientific knowledge to control and improve the current status of apiculture on how to use modern honey production technology to enhance quantity and quality of honey and proliferate colony size reducing absconding.

8. Apiary site should be far from poisonous plant species to bees such as avoiding white flowers (*Apodytes dimidiata*) and red flowers (*Euphorbia catinifolia*) to increase and maintain colony size and swarming success.

9. Other researcher may continue the research for further investigation on challenges the current status of apiculture that affect honey production in the district.

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8. Appendices

8.1 Appendix 1. Questionnaires used for data collection

Addis Ababa University

College of Natural Science

Department of Zoology

Questionnaire

Questionnaire will be filled by bee keepers and DA for survey of Status of Apiculture in Gida Ayana 'Woreda', Oromia Regional State, Western Ethiopia.

Dear questionee(respondent),this study (survey) conducted in Oromia Regional state, Western Ethiopia, E/Wollega zone, Gida Ayana 'Woreda' for the purpose of identification of major problems reducing the productivity of honey and post honey harvest in the district as primary data collection. Therefore, for the success of this study your response is decisive factor. This questionnaire will be filled by respondents selected randomly from the area. Since the quality and success of this study depends on the information you supply, you are kindly requested to provide your genuine response. Right at the outset, I would like to assure you that your response will be used only for research purposes and will be kept confidential. Put (X) in the box provided for close ended questions and write responses on the space provided for open ended questions. There is no need to write your name.

Data collected by: Garoma Beyene; Tel.0917441843; E-mail: garomabeyene@gmail.com

Please read the questions attentively, before try to attempt to reply:

1. Don't write your name on questionnaire paper

2. Look in detail all instructions or heading

3. After reading the question carefully, reply correct answer using X mark in the box.

4. be sure for your reply

Profile of the questionee (Personal information of the respondent)

Name of Your 'Kebele'_____

Your sex:

Male	Female

Your Marital Status:

Married	Unmarried	Divorce

Your Educational status:

Illiterate	Primary school	Secondary school	Above

Your age Group:

Age Group	15-30	31-50	Above 50

How you start bee keeping:

1. Self-interest of bees: ☐
2. Catching bee swarm: ☐
3. Getting bee colony through gift from parents: ☐
4. Inheritance: ☐

Which gender more involved in practice of bee keeping:

Male	Female

Bee keeping practice accustomed of you is:

1. Side way in addition to other agricultural activities (Non-farm & Farm sector) ☐
2. Only base livelihood on this non-farm sector ☐

Honey bee hive usage; Colony of bees & productivities of honey: tick(X) in the box & fill in the blank space.

Types of Hives used by you	Total Hives per year you used	Place of hanging hives	Total honey yield per year in (Kg)	Honey productivity in (Kg/hive/season)		Bee wax In(Kg)
				Major season(write)	Minor season(write)	
Traditional hive & ethio ribirab				_____month _____Kg honey in total	_____month _____Kg honey in total	
Top bar hive (transitional)				_____month _____Kg honey in total	_____month _____Kg honey in total	
Improved frame hive				_____month _____Kg honey in total	_____month _____Kg honey in total	

Amount of honey you harvest per year in (kg)?

10-100 □ 101-200 □ 201-300 □ 301-400 □ 401-500 □ 501-600 □ above 600 □

Trends of honey production

From 1-10 years	Honey yield			Reasons for that yield status stated									
	Increase	Decrease	Static(stationary)	Governmental attention		Involve NGO's		Season of rain		Enough Types of forage & water availability		Availability of honey bee colonies	
				Yes	No	Yes	No	Yes	No	Yes	No	Yes	No
Usage of Apiculture													
Quantity of honey													
Quality of honey													
Bee colony													
Be forage(trees)													

Material support provision for hive construction for honey production: DA: ☐

Government: ☐ NGO's: ☐ Private: ☐

Rank! By giving 1, 2, 3, 4, 5, and 6 respectively that you think as major constraints of apiculture in your (study) area:

Constraints	Rank						
	1	2	3	4	5	6	7
Lack of rain fall							
Shortage of bee forage							
Application of chemicals(pesticide/herbicide)							
Pest and predator							
Absence of policy in Apiculture							
Others							

Reasons for involvement in bee keeping activities and harvesting honey:

A/ income generation used for ☐

B/market initiation: High ☐

Medium ☐

Low ☐

C/ Household consumptions ☐

D/Others, ☐ write_____

Major pests identified in and around study area:

Pests and predators	Seasons of incidence			Types of damage			
				Honey bee	Bee brood	Hive	Bee product
	Mentioned	Yes	No				
Ants ☐	Year round						
Birds ☐	April-July						
Spiders ☐	Year round						
Honey badgers ☐	June-September						
Termites ☐	Year round						
Snakes ☐	Year round						
Wax moth ☐	May-September						
Others list:_____ _____	_____ _____						

Techniques used by bee keepers to protect pests and predators. Write as much as possible on space provided.

Ant protection_____

Bird's protection_____

Spider's protection_____

Honey badger protection_____

Termite's protection_____

Snakes protection_____

Wax moth protection_____

Types of flora (flowering plants) available around apiary area (study area). List them by giving their local name as much as possible.

1._____2._____3._____

4._____5._____6._____

7._____8._____9._____

10._____11._____12._____

From above which one is poison to honey bee? _____

The influence of forest clearing (deforestation) on honey production:

High ☐

Medium ☐

Low ☐

Give your household head information:

1. Household size_____

2. Total farm size & membership of cooperatives _____, its influence on:

Honey production: High ☐

Medium ☐

Low ☐

3. Distance to the nearest 'market' & index of access to communication facilities (Radio, TV, Mobile phone
etc.).Describe_____

4. Nearest 'market' cost of honey per Kg/per Year_____ ET Birr. This market cost is in the manner of_____ year to year:

Increasing ☐

Decreasing ☐

Constant ☐

If your reply is decreasing, reason
out_____

Management of bee colony & honey harvested: with the regard of

1. Times of bee hives supervised_____

2. Bee colony absconding_____

3. During harvest, where do you place? A/ Bee colony_____,

B/Honey comb harvested_____

Where do you keep your hives? (Your answer can be more than one)

A. Backyard in open space □

B. Backyard in open space on trees □

C. Backyard under shelter made for this purpose □

D. On trees far away from residence area □

E. Any other specify _____

Have you ever got training on honey production? A. Yes □ B. No □

6. If your answer to question above is, yes, list the benefits have you gained from the training.

A._____

B._____

Have you ever faced problems in your honey production activities? A. Yes □ B. No □

8. If your answer to question above is, yes, list the problems you faced.

A._____

B._____

Does the government give you support to overcome some of the current limiting factors of honey production? A. Yes □ B. No □

If your answer to question above is, Yes, list the support you got from the government.

A._____

B._____

8.2 Appendix-1 Interview questions for apiculturist

Interview questions for apiculturist

1. Do you have potential of honey production?

2. Is there any currently affecting factors that limited your honey production?

3. Which current factor is highly affecting your status of apiculture activities?

4. How do you overcome current factors limiting honey production qualitatively and quantitatively traditionally?

5. Do you have had any training from government or NGO or both?

6. Is there a plant, which affects bee in your districts?

7. Do you use any chemicals like herbicide, pesticide on your other fields farming?

8. Do you have modern hive? Let us observe and count to know how many and gather actual data.

9. If you have modern hive how about the safety of bee and quality of the bee products?

10. Do you harvest enough products from traditional hive? If not, why?

11. What is your idea in the future to mitigate factors limiting honey production and concerning current status of apiculture what are your feature opportunities in apiculture?

8.2 Appendix-2 Some of the sample of Apiculturist Respondents in Gida Ayana district.

8.3 Appendix 3 Interview questions for the district agricultural office expert

ADDIS ABABA UNIVERSITY
COLLEGE OF NATURAL AND COMPUTATIONAL SCIENCE
DEPARTMENT OF ZOOLOGICAL SCIENCES

Secondary data collected From Gida Ayana Agricultural office to assess the current status of apiculture and post-harvest honey handling and constraints on the apiculture in Gida Ayana district, data from the Woreda Agriculture Bureau and using semi structured questionnaires.

Sample Frame list-For the purpose of MSC. thesis data analysis

Year		2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	Types of bee hive used		
Reference year		1	2	3	4	5	6	7	8	9	10	Tradit-ional hive & ethio ribirab	Top-bar hive (transitional)	Impro-ved frame hive
Status of Apiculture	Increasing													
	Decreasing													
	Stable													
Marital status	Married													
	Unmarried													
	Divorce													
	Total													
Sex	Male													
	Female													
	Total													
Age group	15-30													
	31-50													
	Above 50													
	Total													
Educational Status	Illiterate													
	1^0,													
	2^0;													
	>													

Interview questions for the district agricultural office experts

Is there any potential of honey production in the district?

What is the current status of apiculture in that of honey production?

How currently the household in the study area are engaged in the activities of apiculture in producing honey?

What are lists of the current influencing of honey bees in limiting honey production?

Which kind of indigenous knowledge the apiculturists are used to alleviate and overcome these problems?

What measurement to be taken by government to mitigate factors limiting honey production?

Is that enough bee products from the districts as compared to availability of natural resource?

If there is no enough honey in the districts, what is your commitment to prove the problem?

In the future to improve honey production and to change the lifestyle of apiculturist what kind of activities you plan. Data collected by: Garoma Beyene, Tel. 0917441843(Mobile phone), and E-mail: garomabeyene@gmail.com

Data collected by: _____Sign._____Date_____

Confirmed by:_____ Sign._____ Date_____

8.4 Appendix- 4 Lists of Some Honey Bee Floras in Gida Ayana District

Local name	Scientific name	Plant type
Buna	*Coffee Arabica*	Vegetable
Ebicha	*Vernonia amygedalina*	Shrub
Baddeessaa	*Syzygium guineense*	Tree
Waddeessa	*Cordial Africana*	Tree
Somboo	*Ekebergia capensis*	Tree
Bargamoo	*Eucalptus spp*	Tree
Misingaa	*Sorghum bicolor*	Crop
Mango	*Mangifera indica*	Vegetable
Nuugii	*Guizotia abyssinica*	oil crop
Arbuu	*Ficus sur*	Tree
Boqqolloo	*Zea mays*	Crop
Atara	*Pisum sativum*	Crop
Muka arbaa	*Albizzia gummifera*	Tree
Hagamsa	*Carissaspindrum*	Tree
Birbirsa	*Podocarpus falcatus*	Tree
Hoomii	*Prunus Africana*	Tree
Ejersa	*Olea Africana*	Tree
Abayyii	*Myrica salicifolia*	Tree
Odaa	*Apodytes Dimidiate*	Tree
Konbolcha	*Maytenussene Gakensis*	Tree
Haadaa	*Guizotia cabrascabra*	Herb
Reejjii	*Vernonia auriculifera*	Shrub
Siddisa	*Trifolium rueppellianum*	Herb
Salixa	*Sesamum orientale*	Oil crop
Pappayyaa	*Carica papaya*	Vegetable
Qilxuu	*Ficus vasta*	Tree
Bakkaniisa	*Croton macrostachyus*	Tree
Laaftoo	*Acacia abyssinica*	Tree
Urgessaa	*Premna schimperi*	Shrub
Lolchisa	*Bersama abyssinica*	Tree
Sondii	*Acacia labia*	Tree
Keelloo	*Bidens pachyloma*	Herb
Tuufoo	*Guzotia sp.*	Herb

Source: Fichtl and Admassu (1994)

AFAN OROMO /LOCAL LANGUAGE VERSION FOR APICULTURIST

Univeersiitii 'Addis Ababa'

Kollejii Saayinsii Uumamaa fi

Muummee Qorannoo Bineeldotaatti

Iyyaafannoo

Iyyaafannoon kun kan guutamu Kaannisa Horsiisaan fi 'DA' ttin haala horsiisini kaannisaa aanaa Giddaaa Ayyaanaa irraa, Naannoo Oromiyaa, Dhiha Etoophiyaatti jiru dha.

Jaalatamoo Iyyaafannoo kana guuttanii,Qorannoon kun kan geeggeeffaamu,Naannoo Oromiyaa,Dhiha Etoophiyaa,Baha Wallagaa Aanaa Giddaa Ayyaanaatti ta'ee;kaayyoon Iyyaafannoo kanaa rakkowwan gurguddoo Oomisha damaa booda sasaabamuu irratti aanaa kana keessatti dhiibbaa fidan adda baafachuu ta'a .Kanaafuu bu'aa qorannoo kanaaf deebii sirrii sin kenitaan murteessaa dha.

Oodeeffannoo iyyaafannoo kana keessa guutuuf filatamitanii naannoo jiraatanii irraa ho'inaan akka guutan kabajaan sin gaafana.

Kaayyoon qorannoo kanaas iyyaaffannoon argama waan ta'eef bakka gaafatamitanit mallattoo(X) ka'uudhaan sanduqa kaayame irratti deebiftu.Kan biraa bakka duwwaa gaafatamitani barreessuun banaa sana guutaa.Maqaa keessan barreessuun hin barbaachisu.Garuu gaaffii gaafatamtaniif seeraan qajelfama isaa dubbisaa guutaa, X yookiin barreesaa.

Data collected by: Garoma Beyene; Tel.0917441843; E-mail: garomabeyene@gmail.com

Namini Iyyaaffannoo kana guutu gochuu qabu.

Maqaa Ganda kee_____

Saalii kee:

Dhiira	Dubara

Haalli gaa'eelaa kee:

Kan fuudhe	Kan hinfuudhiin	Kan baasee jiru

Haalli barnootaa kee:

Kan hin baranne	Sadarkaa 1ffaa	Sadarkaa 2ffaa	Isaa ol

Umuriin kee keessa jiru:

Umurii keessa jiritu	15-30	31-50	Above 50

Horsiisa kaannisaa akamiin eegalte:

1. Fedhii kaannisaan: ☐
2. Gurmuu kaannisaa qabuun: ☐
3. Gurmuu kaannisaa warra koo irraa fudhachuun: ☐
4. Gurmuu kaannisaa gaagura dura jiru keessa gara biratti dabarsuun (diligata dabalataa): ☐

Saala kamitu caalaatti horsiisa kaannisaa keessatti hirmaata:

Dhiira	Dubara

Barsiifatini ykn. Aadaan horsiisa kaannisaa kun sibiratti kan gegeefamu:

1. Qonnaa kan biraa biratti (cinatti) dabalataan (Nan qotas) ☐
2. Jireenyi koo guutuun horsiisa kaannisaa kana irratti qofa hunda'a ☐

Gosa gaaguraa kam akka fayyadamitu; gurmuu kaannisaa gaagura keessaa qabuu fi ammam dama akka argatuu: Saanduqa gadii jirutti "X" guutuunii fi bakka duwwaatti barreessuun.

Gosa gaaguraa fayyadamituu	Baay'ina isaa waggaatti	Baka keessu ykn itti hiitu	Waliigala dama wagaatti argatu (Kg)	Oomishumaa damaa Kg. wayita gaagura 1 keessa argattu (Kg/gaagura/waqitii) baafatutti		Gaga hargatuu hoo Kg. waliigala waggaatti(Kg)
				Waqitii isa duraa buufatutti(barreessi)	Waqitii isa lammaffaa buufatutti(barreessi)	
Gaagura aadaa				Ji'a bafatu_____ Dama Kg. walitti argatu_____	Ji'a bafatu_____ Dama Kg. walitti argatu_____	
Gaagura ce'umsaa				Ji'a bafatu_____ Dama Kg. walitti argatu_____	Ji'a bafatu_____ Dama Kg. walitti argatu_____	
Gaagura ammayyaa				Ji'a bafatu_____ Dama Kg. walitti argatu_____	Ji'a bafatu_____ Dama Kg. walitti argatu_____	

Waggaatti dama Kg. ammamii hanga ammamiitti argata (kg)?

10-100 □ 101-200 □ 201-300 □ 301-400 □ 401-500 □ 501-600 □ 600 ol □

Erga waggaa 10 as oomishini damaa akkam keessa jira

Waggoota darban 10 f	Oomisha damaatiin			Sababa kanaaf eenyuu/kami									
	Dabalaa deema	Hir'aa deema	Dhabbataa dha	Hordoofii mootummaa jiraa		Miti mootummaan hoo		Sababa roobaan hoo		Biqiltuu daraaraa kaannisitti sooratuu fi bishan ga'a		Jirachuu gurmuu kaannisaani hoo	
				Eeyyee	Waa'uu	Eeyyee	Waa'uu	Eeyyee	Waa'uu	Eeyyee	Waa'uu	Eeyyee	Waa'uu
Itfayyadamini horsiisa kaannisaa													
Baay'ina damaa													
Qulqulina dama													
Gurmuu kaannisaa													
Daraaraa biqiltuu kaannisitti soorratu													

Dhiyessii meeshaalee gaagura hojetamuu fi dama oomishamu kanaaf eenyutu raawata:
DA: ☐

Mootummaa: ☐

Miti Mootummaa: ☐

Dhuunfaan: ☐

Rakkowwan gurgudoo dha kan jetuu fi horsiisa kaannisaa ykn.oomisha damaa nannoo atti jiritu irratti guffuu ta'anii argaman 1, 2, 3, 4, 5, 6 jedhii sadarkaa kennif:

Rakkoo guffuu ta'an	Sadarkaa rakkoon kun itti argamu kami						
	1	2	3	4	5	6	7
Dhibimsa bokkaa							
Dhibimsa daraaraa							
Keemikaala aramaa ykn. Ilbisaa tti biifamu							
Soorrattota kaannisaa ykn. Damaa sooratan							
Dhibeenya seeraa fi dambii horsiisa kaannisaa							
Kan biraa							

Sababa ati horsiisa kaanisaa keessatti qooda fudhatu kami:

A/ galii madisiisee fayyadama kan akka ☐

----------ta'aniif oolifachhuf-

B/Hawanni gabaa damaa: Ol aanaa ☐

Giddu galeessa ☐

Gad aanaa ☐

C/ Soorata maatiif oolichuuf ☐

D/ Kan biraaf, yoo ta'e ☐

barreessi_____

Kanneen kaannisaa fi dama nyaatanii mancaasan gurguddoon naannoo kee jiran:

Nyaattoota kaannisaa ykn. Damaa	Waqitiin isaan itti dhufan			Kaniisaan nyaatan			
		Eeyyee	Waa'uu	Kaannisa	Jiisa	Gaagura	Oomisha kaannisaa
Goondaa ☐	Waggaa guutuu						
Sinbirro ☐	Eeblaa-Waxabajjii						
Sariitii ☐	Waggaa guutuu						
Hamaa ☐	Waxabajjii – Fulbaanaatti						
Ririma ☐	Waggaa guutuu						
Bofa ☐	Waggaa guutuu						
Daanoo gagaa ☐	Caamisaa-Fulbaanaatti						
Kan biraa:_____ _____ _ _____ _	_____ _____ _						

Tooftaan namni kannisa kana horsiisu ykn. ati fayyadamee (tee) warren kaannisaa fi dama soorratan armaan gad jiraan ofi irraa dhorkan ykn dhorkitu barreessi.

Goonidaa dhorkuuf_____

Sinbirroo dhorkuuf_____

Sariitii dhorkuuf_____

Hamaa dhorkuuf_____

Ririma dhorkuuf_____

Bofa dhorkuuf_____

Daanoo gaga dhorkuuf_____

Gosa biqiltuu daraaraa kaannisitti sooratu naannoo kee jiru tarreesi.

1._____2._____3._____

4._____5._____6._____

7._____8._____9._____
10._____11._____12._____

Kanneen gubanatti tarreessite keessaa biqiltuu kamitu kaannisaaf summii dha?
_____**Dhiib aan bosona ciruu oomisha damaa irratti qabu:**

Ol-aanaa ☐

Gidu-galeessa ☐

Gad-aanaa ☐

Odeeffannoo abbaa/haadha warrummaa kee kenni:

1. Baay'ina maatii kee_____

2. Bal'ina lafa qonnaa kee hektaaraan fi miseensota sigargaarani _____, fidhiibaan isaan oomisha damaa irratti qaban:

Ol-aanaa ☐

Gidu-galeessa ☐

Gad-aanaa ☐

3. Fageenya bakki gabaa sitti dhiyoo jiru qabuu fi wal-qunnamittii odeeffannoo kennan ati qabidu (TV, Raadiyyoo fi Moobaayila karaa fi kkf.)

_____

4. Gatiin damaa gabaa sitti dhiyyeenyaan jiru Kg. tokkoo Brrii _____dha waggaatti. Gatiin gabaa damaa kun waggaa waggaa tti _____ ta'aa deema:

Dabalaa ☐

Hir'ataa ☐

Dhaabbataa ☐

Deebiin kee Hir'ataa deema yoo ta'e, sababa isaa barreessi

_____

Akkaataa qabinsa gurmuu kaannisaa dama oomishamee ilaalatee:

1. Yeroo meeqaf akka gaagurii fi kaannistti gaaguraa keessaa ilaalamu (to'atamu)

_____

2. Godaansa gurmuu kaannisaa ilaalchisee

_____

3. Yeroo oomisha damaa baafatu, bakka ati keewwattu eessa? A/ Gurmuu kaannisaa keessu eessa

_____,

B/Dhaaba dama qabu keessu eessa _____

Gaagura kee eessatti hidhatta kaannisa horsiisuuf? (Deebii ati laattu tokkoo ol ta'uu danda'a)

A. Boroo manaa muka hin qabine ☐

B. Boroo manaa muka qabu ☐

C. Boroo manaa gaaddisa kanumaaf hojjetame qabu ☐

D. Muka mana jireenyaa irraa fagoo ta'e irratti ☐

E. Kan biraa yoo jiraate ibsi _____

Kannaan dura leenjii horsiisa kaannisaa fi oomisha damaaf fudhatee taa? A. Eeyyee ☐
B.Waa'uu ☐

6. Yoo deebiin kee gara Eeyyee ta'e; faayyidaa leenjicha irraa argate tarreessi.

A. _____

B. _____

Kannaan dura rakkoon oomisha damaa irratti simudate jiraa? A. Eeyyee □ B. Waa'uu □

8. Yoo deebiin kee gara Eeyyee ta'e; rakkowwan siin mudatan tarreessi.

A. _____

B. _____

Mootummaan rakkowwan oomishitummaa damaa irratti dhiyeenyatti gargaarsa isinii godheeraa?

A. Eeyyee □ B. Waa'uu □

Yoo deebiin kee Eeyyee ta'e; gargaarsa Mootummaa irraa argate tarreessi.

A. _____

B. _____

Gaafii qomaa hoorsiisaa kaanisaaf ta'u

1. Ga'umsa dama oomishuu qabdaa?

2. Dhiyyeenyatti haalli oomishittummaa damaa kee daangessu jiraa?

3. Haalli oomishittummaa damaa kee siin daangessan keessaa ol-aanaan kami?

4. Tooftawwan aadaan ati haalowwan dhiyeenyatti bay'inaa fi qulqulina damaa daangesan furmaateffattan (damdamattan) maaliifaa dha?

5. Kana dura leenjii mootummaa ykn. Miti mootummaa irraa argatee beektaa?

6. Biqiltuun kaannisa miidhan (summeessan) aanaa kana keessa jiruu?

7. Keemikaala kan aka farra aramaa fi fara ilbisaa lafa qonnaa keessan irratti ni fayyadamituu?

8. Gaagura ammayyaa qabduu? Dowwiin ilaalee halakoofnu, Meeqa akka qabduu beekuu fi odeeffannoo dhugaa fudhachuuf.

9. Yoo gaagura ammayyaa qabdu ta'e, nageenya kaannisaa fi quliqulina damaaf akkamii?

10. Dama ga'aa gaagura aadaa irraa ni argatuu? Miti yoo ta'e, maaliif sababini isaa?

11. Yaada ati gara fulduuraatti rakkowwan oomisha damaa daangessan dandamachiisuuf ykn.furmaatessuuf ta'e halaa amma irra geese jirittuun wal-qabatee hirreen gara fulduraatti omisha dammaaf horsiisa kaannisaaf ati qabdu maalii?