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STUDIES ON FACTORS LIMITING HONEY PRODUCTION IN GECHI DISTRICT OF ILUBABOR ZONE, OROMIA REGIONAL STATE, ETHIOPIA

BY

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DECLARATION

This is to certify that this thesis entitled" Studies on Factors Limiting Honey production in Gechi district of Ilu Ababor 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 Tolesa Birhanu. 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.

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Lists of Abbreviations/ Acronyms

AGP: Agricultural Growth Program

AMDE: Agribusiness and Market Development (Program)

ARSD: Apiculture Research Strategy Document

CSA: Central Statistics Authority

GDADO: Gechi District Agricultural Development Office

GDRLA & EPO: Gechi District Rural Land Administration & Environmental Protection Office

HBRC: Holeta Bee Research Center

MAAREC: Mid-Atlantic Apiculture Research and Extension Consortium

MOARD: Ministry of Agriculture and Rural Development

Abstract

This study was conducted in Gechi district, Ilubabor zone, Oromia Regional State from Septemb er to July 2010E.C. The main objective of this study was to assess factors limiting honey production and give recommendations for mitigating the challenges in honey production in the study area. To address these objectives questionnaires and interviews were used to collect primary data. Different documents were reviewed for secondary data generation. Using a purposive sampling technique, six kebeles were selected purposely depending on variations in agro-ecology and honey production potential and Cross-sectional research design was used to describe the beekeepers' characteristics. Primary data were collected from 167 respondents that were randomly and proportionately selected from the six kebeles. The data were organized and analyzed using Microsoft Office excel 2010 software. The result of the study showed that honey production activity was mainly undertaken by younger people in the study area. Majority of the beekeepers about (53.9%) did not attended school and about (13.77%) of the respondents did not attend formal education in their life, but they took informal adult education and they know how to write at low level. From the result of this study, the main limiting factors that affect honey production mentioned by respondents were ants (40.72%), traditional technology (27.55%), lack of proper management for bees and hives (10.78%), herbicide/other insecticide (5.99%), deforest ation (4.79%), decline of bee colonies (2.99%), shortage of bee food (2.99%), improper harvestin g time (2.99%) and monkey (1.2%). The data also revealed that traditional hives, lack of training on honey production, improper placement of hives, lack of support for the beekeepers and plant species poisonous to bee were also limited honey production in the district. To minimize limiting factors, the beekeepers used different indigenous knowledge such as cleaning apiary site, placing the white ashes around hive stand, moving honeybee colonies from spraying area and hand weeding. The researcher recommended that the beekeepers were able to alleviate the limiting factors through training, by using modern hives, planting bee forage, avoiding the red flowers from the area, conservation of plants and by using the available resources effectively

Keywords: Factors Limiting, honey production, Gechi district,Oromia regional State

CHAPTER ONE

1. INTRODUCTION

Honey is one of the sweetening agents and is defined as the natural substance produced by *Apis mellifera* (Linnaeus, 1758) from the plant nectar. It is a nutritive food containing various kinds of sugar, protein, free amino acids, trace elements, minerals, vitamins, water and enzymes with a high caloric content. Its main sugars are fructose, glucose and dextrose, which are absorbed directly into the blood and provide rapid energy (White, 1980). Honey 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 provides sustainable livelihoods to many small-scale farmers and other rural and urban 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, 2012). It is also one of the four largest beeswax-producing countries in the world next to China, Mexico and Turkey. Honey production doesn't need large size of land, huge budget and complicated technical knowledge. The outcomes of beekeeping are real; some of its outcomes include material goods, income, wellbeing and satisfaction (Nicola, 2009). Beekeeping encourage rural community livelihoods and helps rural people to become less vulnerable to different problems and reduces the danger that run them into crisis. Honey production as an activity gives great potential for development in almost all African countries. Beekeeping does not compete severely for resources with other farm enterprises (Gentry, 1982; Adjare, 1990; Bradbear, 2004; MAAREC, 2004).

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). Rural and Urban people are engaged in the honey production, trading and selling of honey beer (tej). In every town, "tej" production is big businesses, which generate income (NURU, 2007). Honey has high social and cultural value in Ethiopia. It has different functions in many traditions such as during marriage, birth and funeral ceremonies.

Engaging in honey production and beekeeping have a wide range of economic contributions, income generation from marketing honey and its by-products such as beeswax, royal jelly, pollen, propolis, bee colonies and bee venom and the creation of non-gender-biased employment opportunities. Beekeeping and honey productions are still operating in the old traditional ways and require modernization. Poor quality and low productivity of bee products are the major economic problems for rural beekeepers because of lack of skill to manage their bees and bee products. Different resources are required for honey production activities. These are the bees, plants, skill and knowledge of the beekeepers, equipment, transport, financial, skill in packaging and marketing (Nicola, 2009).

The major factors that limit honey production in Ethiopia are insect pests and predators, which include mammals, birds, reptiles, beetles, ants, wasps and flies (Crane, 1990). The other factors that limit honey production are traditional technology, lack of proper management for bees and hives, agrochemicals (herbicide & other pesticides), improper placement of hives, lack of training, deforestation, decline of bee colonies, shortage of bee food and poisonous plant to bees. In addition to these, as far as researcher knowledge is concerned there is no research conducted to analyze factors limiting honey production in this specific study area. Therefore, the study focused on factors limiting honey production in southwest of Oromia Regional State, Ilubabor Zone, Gechi district, in order to mitigate the challenges of honey production.

1.2 Statement of the Problem

Gechi district is rich in 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 districts for apiculture sub-sector, but the district still could not exploit the existing potential to the required level.

Because, of different problems that limit honey production activities in the district like pests, traditional technology, poor management of bees and hives, lack of training & improper placement of hives, disease, deforestation, parasite and herbicides/other insecticide chemicals. Ejigu et al., (2009) pointed out shortage of bee forage, pesticide poisoning, lack of skilled man power and training institution, low level of technology used, honey bee pest and disease, shortage of bee colony in apiculture as the major constrains of bees and affect beekeeping in

Amhara region. However, in Gechi district there is no available information about the pests of honeybees, their prevalence, geographical location and other limiting factors in particular. Therefore, from this we understand that the role of honey production activities of the community is insignificant. In this connection, the current study was designed to assess factors limiting honey production in south western Oromia Regional State, Ilubabor Zone, Gechi district.

1.3 Objectives

1.3.1 General Objective

- ✓ To assess factors limiting honey production and give suggests possible solutions for the challenges

1.3.2 Specific Objectives

- ✓ To assess indigenous knowledge of honey production in overcoming the problems associated to beekeeping
- ✓ To identify pests and other factors associated to beekeeping and honey production in Gechi District

1.4 Research Questions

-What are the factors that limit honey production?

-Which of the factors are more important in limiting honey production?

-What kinds of indigenous knowledge are used to overcome the problems?

-How do beekeepers alleviate the problems?

1.5 Significance of the Study

This study is mainly important for three major reasons. First, the study investigates factors that limit honey production in the study area and recommend solutions to enhance honey production, which eventually increase the livelihoods of the community. Secondly, the findings of the research can also serve as valuable input for the district concerning honey production activities. Honey production does not need huge capital and large size of land and does not depend on importable inputs. Thirdly, the country can earn foreign currency by exporting honey and bees wax to different countries. In addition to this, the information collected during this study will serve as a road map for other researchers interested to carry out additional studies in this area.

CHAPTER TWO: LITERATURE REVIEW

2.1 Honey Production in Africa

Both humans and honeybees originated in Africa, each species migrating out of the continent on several occasions (Gidey, 2004). Early people took honey from hollow trees found in the forest. The first beekeepers were hunters, seeking out wild nests of honeybees, which often were destroyed to the sweet reward called honey. Honeybee 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), *A. 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 beekeeping and get benefit from bees. However, this traditional beekeeping practice is not evenly distributed among the people. Therefore, in Africa, some farmers are getting advantage from harvesting bee product. In Africa, Beekeeping in beehives is practiced predominantly in Egypt, Kenya, Ethiopia and Tanzania (Hussein, 2000).

2.2 Production of Honey in Ethiopia

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 beekeeping than any other country in the world. Beekeeping 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.

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).

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. Beekeeping can also be supplementary to crop production by facilitating pollination (Wilson, 2006).

In Ethiopia, there are two honey-collecting seasons: the major one is that carried out from October to November and the second one from April to June. However, in addition to these major harvesting periods, there are many small harvesting periods, which depend on the type of flowering plants and rainfall patterns in different agro ecologies, which experienced beekeepers 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 the other factors that affect beekeeping.

Parasites and diseases also affect beekeeping 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 honey production. Honeybees can also be affected when using plants for their nectar that had been treated with a high concentration of pesticides. Beekeepers 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).

Honey production 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. Beekeepers therefore, introduce sugar syrup in their feeds at least 6weeks 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 millifera jementica, A. m.scutellata, A. m.bondasii, A. m. monticola and A. m. woyi-gambella* (Amsalu et al., 2004). Among those, *Apis mellifera bondasii* is the famous one in the country.

2.3 Honey Production in Oromia

Oromia is the well-known honey and beeswax producer region in Ethiopia. Regional contribution of honey production in Ethiopia distributed as Oromia (41%) SNNPR (22%), Amhara (21%), Tigray (5%) and other regions together(11%) (CSA(2003). Different species of plants, high bee colonies, good water supply, suitable agro-ecological and climate condition among others are resources vital for honey production which most regional state in Ethiopia owned. The resource that is 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.

Ilubabor zone is one of the Oromia regional state's zones with high potential of honey and bees wax production. The livelihoods of Gechi 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.

2.4 Honey Production in Gechi District

Gechi district is well known in honey production activities. But, the method of honey production in this district is mostly traditional, which involves traditional hives. The traditional hives are made from locally available materials like *Vernonia hymenolepis* (soyyama- local name), and the external part, is covered by grass called *Snowdenia polystachya (*muujjaa-localname*)* and the internal part of the hive is plastered by cow dung.

The advantage of traditional hives is that it does not require skilled man power and not expensive. The disadvantage of this hive is, it is not favorable to increase quantity and quality of honey produced because there is no possibility of having partition- ship for honey and brood and no standard dimension regarding their length and their diameter, inconvenient to inspect and the bee construct irregular comb, which is difficult to harvest. In traditional honey production, the hive condition, affect the honey, wax and bee colonies (Gichora, 2003).

2.4.1 Transitional Bee Hives (Intermediate)

Intermediate hives are made of timber and other locally available materials. It has atop bars on which honeybee attach their combs. The main advantage of this hive is that easy to inspect the internal problem of the hives, to avoid damaging of brood during harvesting of honey and easy to open (HBRC, 2004).

2.4.2 Modern Beehive

The quantity and quality of honey produced in this type of hive is better than transitional and traditional hive because this type of hive has queen excluder, brood chamber and honey chamber, seasonal inspection, centrifugal honey extractor and possible to move swarm from place to place for searching bee forage and pollination service. It uses different types of frame hives. The most common frame hives being used in our county are Zandar and Langsroth. Others such as Dandant, foam hive and modified Zander is rarely used (HBRC, 2004).

2.5 Important Parameters to be considered in Honey Production

2.5.1 Natural Vegetation

Presence of natural vegetation and cultivated crops are the basic for honey production. To decrease shortage of bee food and to increase availability of nectar and pollen for honeybee, the traditional honeybee plants must be planted and conserved. These plants are; *Croton machrostac ys* (bakkaniisa), *Vernoni amygdalina (*ebicha), *Guizotia spp* (nuugii), *Syzygium guineense* (badde essaa-localname), Erica arborea in Ethiopia (Gemechis *et al.*, 2012).

2.5.2 Fresh Water and Whether Condition

Water is not only needed for honeybee consumption but also for brood rearing and hive ventilati on. Humid and wet area is not suitable for honey production, because high humidity in the area affect the quality of honey due to an increased amount of moisture content.

2.5.3 Pest and Predators of Honeybee

Honeybee and their products are exposed to various pest and predators. These pests include ants, beetles, reptiles, birds and wasps (Hepburn & Radloff 1997). These pests destroy the bee colonies and reduce their product. Ethiopia as part of sub-tropical countries, the land and its environment is favorable for bees and different honeybee pest and predators that interact with the life of honeybee (Dessalegn, 2001).

2.5.4 Chemical Poisoning (Pesticide including Herbicide)

Herbicide and other pesticide chemicals are now the major problems to the beekeepers. Pesticide chemical used for crop pests, tsetse fly, weed, household pests and mosquito damage their honeybee and their product. Insecticide used for protection of tsetse fly and mosquito directly kills the honeybee and herbicide applied on weed damage honeybee flowers. Examples of these chemicals are; 2,4D, DDT, malathion and acetone. Some of the beekeepers totally lost their bee colonies due to this agrochemical (Kerealem et al., 2009). Therefore, apiary site should be free from these chemicals.

2.6 Importance of Honey

2.6.1 Economic Importance

Honey has been used to generate income, as well as for nutritional and medicinal value for local communities (Benjamin & McCallum, 2008). Honey is very important for healing wounds, skin treatment (Brad bear, 2004). In Ethiopia, honey is almost used for local consumption, and to a very large extent for brewing of mead (Tej). Almost no wedding or other cultural, religious and social events cannot be imagined without the honey wine 'Tej' in the past (Beyene & David, 2007).

2.6.2 Bees Wax and Propolis

Wax is essential primarily for honeycomb, cosmetic industries, varnishes, polishes and for queen cups preparation to be used for queen rearing to develop and multiply bee colonies. In addition, wax is also used for candle making especially in Orthodox churches has a long history in

Ethiopia (Ayalew, 2006). The annual production of wax in Ethiopia is estimated at 5000 t (Holeta Research Center, 2004). Propolis is a substance that is used by the bees to seal up the hive,to strengthen the comb, for wind protection and defense. It comes from the sticky exudates of trees and buds such poplars, and some conifers. Propolis has anti-microbial properties, so it is used to treat various disorders. It is effective in treating hypertension, coronary diseases and arteriosclerosis. Propolis is sold in capsules at health food stores as a health supplement (Crane, 1990).

2.6.3 Royal Jelly and Venom

Royal jelly is synthesized by Young nurse bees to be fed to the queens and queens' larvae. It is collected and used in the oriental world for medicinal purposes. The uses include cosmetics, soap, lotions, medicine and dietary supplements (Crane, 1990). Generally, royal jelly, propolis, and bee venom have high demand globally (Ayalew & Gezahegn, 1991; ARSD, 2000; Gezahegn, 2001). Venom is synthesized by workers and queens. It has been used for treating various human ailments, especially for anti-inflammatory and ant arthritic effect. Some components of the bee venom might have more effect than other serums in desensitizing people who are allergic to be venom. It might also be useful for persons with rheumatoid arthritis

CHAPTERTHREE: MATTERIALS AND METHODS

3.1 Study Area Background

The study was conducted in Gechi district, South West Oromia National Regional State which is found at 465km away from Addis Ababa. Based on agro ecology the area is classified in to high land (5%), mid land (85%) and low land (10%). Gechi district is located in the range of 8^0 $12^{'}$ 03.48$^{"}$N to 8^0 $34^{'}$ 38.80$^{"}$ N latitude and $36^0$18$^{'}$, 07.50$^{"}$E to $36^0$39$^{'}$ 03.87$^{"}$E longitude with an altitudinal range between 1300-2100 meters above sea level. It is boarded by Dedesa Woreda in South, Jimma Arjo Woreda of East Wollega in the North, by Bedele Woreda in the West and Boricha Woreda in the East.

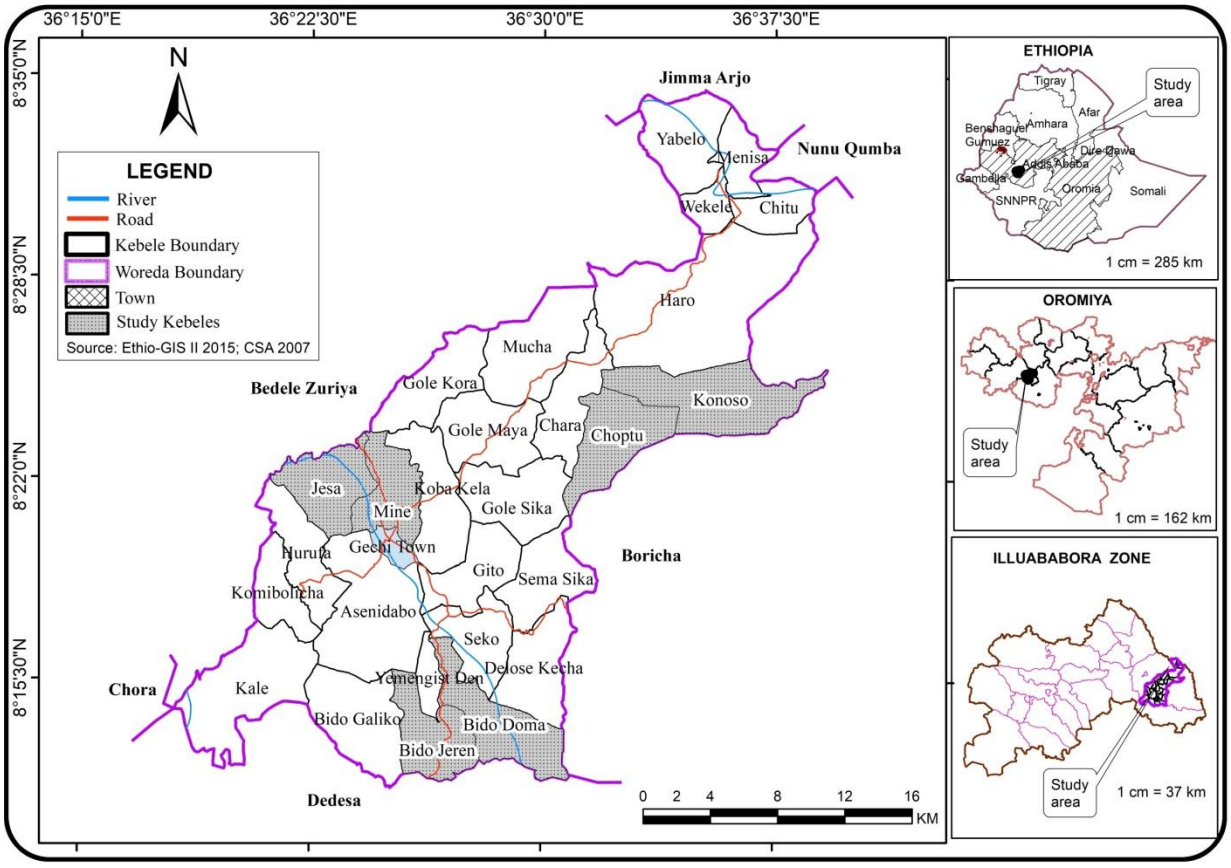

Plate 3.1 Map of Gechi district

Climatically Gechi Woreda consists 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 table below shows, the maximum and minimum temperature of the district is between $26.36c^0$-$9.96c^0$ in December and November, respectively. Temperature increases as one move from dega (highland), woina-dega(midland) then kola(lowland)(Table3.1)

Table 3.1 Average temperature distributions in Gechi district per month, 2009-2010

Months	J	F	M	A	M	J	J	A	S	O	N	D	Total
Monthly Max (^{0}C)	21.46	19.93	22.16	22.2	22.3	20.7	20.93	21.63	20.5	20.7	24.23	26.36	263.1
Monthly Min (^{0}C)	10.03	10.23	11.03	11.1	11.4	10.8	10.36	10.66	10.4	10.46	9.96	10.33	126.79
Annual Average (^{0}C)	15.74	15.08	16.59	16.65	16.85	15.75	15.64	16.14	15.45	15.58	17.09	18.34	194.94

Source: - Gechi Woreda Meteorology Station (2010)

As the table below indicated, total annual rainfall in Gechi Woreda is about 1671mm and it decreases as one move from dega, woina-dega and kola. The maximum rainfall is 429mm in June and minimum is 5mm in December, while no or very minimum precipitation in November, January and February because those months are dry months even in many parts of the country (Table3.2)

Table 3.2 Average rainfall distribution in Gechi district per month, 2009-2010

Month	J	F	M	A	M	J	J	A	S	O	N	D	Total
R.F.(mm)	0	0	19	100	419	429	203	211	170	115	0	5	1671

Source: - Gechi Woreda Meteorology Station (2010)

3.2 Demography of the District

This Woreda is divided into 32 Kebeles of which 31 of them are settled by peasants engaging their livelihood by means of agriculture and one urban center Gechi Town of Gechi 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 90,314 with the composition of 49% male and 51% of female population, which is almost equal. The total area of this Woreda is about 48,652.7hect sharing 2.7% of the total area of Ilubabor Zone (Gechi woreda administration and Agricultural Development Office, 2010). In the 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 beekeeping. Lowland areas of this Woreda are experienced by different types of cereal crops those mostly used for home consumption and cash crops, but mainly used for commercial purpose. The crops include maize, finger millet, sorghum, groundnut, niger seed, sweet potato, cotton, sugarcane, mango, lemon, orange and papaya.

The midlands are known by coffee, teff, maize, sorghum, sweet potato, pearl, chat& millet. Highlands are well known by field pea, barley, wheat, linseed, rapeseed, potato, tomato and avocado (Gechi Woreda Land and Agricultural Development Office, 2010). 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 (Gechi district rural land administration and environmental protection office, 2010).

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 Gechi Woreda. Some of the tourist sites of this Woreda are Fincha'a Dangawaji (Dangawaj Waterfall and cave), Fincha'a Aba Reti (Aba Reti Waterfall), Hursa and Fincha'a Sama (Hursa and Sema Waterfall), Holqa Haro (Haro Cave) and others can be mentioned (Gechi Woreda Culture and Tourism Office, 2010).

Regarding religion, 95% of the societies of the district are Islam, 3% Orthodox and 2%Protestant as well as Wakefata means followers of traditional religion who never follows nor rejects those religions mentioned above. One can simply conclude that as Islamic religion dominates this

Woreda and that of the study area based on the percentage of followers (Gechi Woreda Administration and Government Communication Office, 2010).

3.3 Study Design and Sampling Techniques

For this study, a cross-sectional research design was used to describe the beekeepers' characteristics and to assess factors limiting honey production at specific point in time. The information was collected then organized and analyzed accordingly. Gechi district comprised 32 rural kebeles and one municipal town. From which six kebeles were selected purposely as a sample depending on variation in agro-ecology and honey production potential (2-kebeles from lowland, 2-kebeles from midland and 2- kebeles from highland). To select individual household beekeeping 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 Beekeepers in the district (Table 3.3). The purposive sampling method was used in selecting key informants from the beekeepers and government offices in Gechi district. The sampling units were individual household's bee keeping farmers of six selected kebeles and the sample frame of this study was the list of household beekeeping farmers of six selected kebeles. About 167sample size of the beekeepers from six kebeles were selected from total household beekeepers of six selected kebeles of 288, using Yemane (1967) sampling procedure. The study used data collection instruments such as questionnaire, interview and observation.

3.4 Sample Size Selection

The sample size was determined using Yemane (1967) sampling formula with 95 percent confidence level. This formula was used to calculate the sample size from the total population of the beekeeper 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 household beekeepers

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 household beekeepers were: 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:

$ni = n \times Ni/N$

N=total beekeepers of selected six kebeles

Ni=total beekeepers of each kebele

n=total sample size of selected six kebeles

ni=sample size selected from each kebele

Table 3.3 Distribution of beekeepers households in each kebele

Study area	Name of kebele	Number of beekeepers households in each kebele			Number of sample respondent house hold in each kebele		
		Male	Female	Total	Male	Female	Total
Gechi district	JESA	100	36	136	58	20	78
	MENE	65	37	102	38	21	59
	BEDO JEREN	4	0	4	2	0	2
	BEDODOMA	15	7	22	9	4	13
	CHOPTU	7	2	9	5	1	6
	KONOSO	15	0	15	9	0	9
Total	Six	206	82	288	121	46	167

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

3.5 Data collection method and source of data

Data were collected from primary and secondary sources in order to meet the objectives of the study and answer research questions (Table 3.4). Primary data were collected through questionnaires and interviews from sample respondents who engaged in beekeeping activities and the district Livestock and Fishery development experts. The questionnaire was prepared in English language first and translated to Afan Oromo language. Interviewing some of the beekeepers and livestock experts were needed because the majority of the beekeepers may not read and write to fill the questionnaire. Secondary data mainly from document review of concerned office like climate, demography and other valuable unpublished reports from Gechi di strict rural land administration and environmental protection office (GDRLA & EPO) and Gechi district agricultural development office. For this study, secondary data, which support the primary data, were also obtained from various sources like internet, journals and research

findings. Visual observation was also part of data collection. The primary data collected from the respondents were focused on age, sex, educational status, limiting factors that affect honey production, placement of hives, suitableness of the district, training and support given for the beekeepers, amount of honey they harvested per year, potential of honey production, method they used to overcome the limiting factors, presence or absence of toxic plants and pests in the study area and agro-chemicals using structured questionnaires.

Table 3.4Total number of sample respondents

NO	Respondents	Method of data collection	Total number of respondents
1	Beekeepers	Questionnaires	167
2	Gechi district livestock and fishery development experts	Interview	3
3	Other beekeepers	Interview	7
	Total		177

3.6 Data Analysis Methods

Data were analyzed and interpreted by qualitative (descriptive method) and quantitative (percentage, frequency, tabulation and ratio) methods using Microsoft office excel 2010 software. Calculation of the percentages and frequency of counts were used to arrive at a general picture for the generation of conclusion and used as a tool for analysis of quantitative data. In general, close-ended questions were analyzed through tables (frequency) and percentages to compare results. Open-ended questions including interview and observations were analyzed using descriptive methods.

CHAPTER FOUR: RESULTS

4.1 Age, Sex and Educational Status of Sampled Household Beekeepers in Gechi District

The age, sex and educational status of sampled household beekeepers were shown in Table 4.1.The age of the respondents range from 15 to 70 years with the mean of 42.5 years. The majority of the beekeepers were below 50 years old (85.03%) and about 14.97% of the respondents were above 50 years old. The sampled household beekeepers were male biased such that about 72.45% were males and 27.55% 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 beekeepers about 53.9% did not attended the school and about 13.77% of the respondents took informal adult education, which enabled them to write and read somehow. Those households who got a chance to go to school grouped in into primary school, first cycle education and second cycle education with the proportion of 16.17%, 13.17% and 2.99%, respectively.

Table 4.1: Age, sex and educational status of sampled household beekeepers

Age		Sex						
Year	Percentage	Male	Percentage	Female	Percentage	Educational status	Number of respondent	Percentage
		121	72.45	46	27.55			
15-30	23.96					Did not attended school	90	53.9
31-50	61.07					Can only read and write	23	13.77
Above 50	14.97					1-4	27	16.17
Total	100					5-8	22	13.17
						9-12	5	2.99
						TVET/college	0	0
						University	0	0
						Total	167	100

4.2 Response on suitableness of Gechi district for honey production and types of hives used by the beekeepers

Table 4.2 demonstrated the suitableness of Gechi district for honey production and the types of hives the beekeepers of the district are using. All the respondents disclosed that Gechi district has suitable conditions for honey production because of its huge dense forest, large bee colonies, availability of food & water for the bees and suitable environmental conditions among others. About 65.86% of the hives were found to be the traditional hives, while 4.79%& 26.34% were modern hives and mixed hives (both traditional and modern hives), respectively. Few respondents (2.99%) used both transitional and traditional hives.

Table 4.2: Suitable condition for honey production and types of hives used in Gechi disrict

		Number of respondents(n=167)	Percentage
Does Gechi district have suitable condition for honey production?	Yes	167	100
	No	0	0
	Total	167	100
Which types of hives do you use?	Traditional	110	65.86
	Modern	8	4.79
	Both	44	26.34
	Transitional& traditional	5	2.99
	Total	167	100

4.3 Respondents response on placement of hives in Gechi district

Regarding placement of hives, the majority of the respondents (41.92%) placed their hives on long tree, while 21.55%, 30.54% and 5.99% of the respondents placed their hives on free open space, under simple shelter and under the eaves of home, respectively (Table4.3).

Table 4.3: The Placement of hives in Gechi district

Where do you keep your hives?	Number of respondents n=167	Percentage
Backyard in open space on long tree	70	41.92
Backyard in open space	36	21.55
Backyard under shelter made for this purpose	51	30.54
Backyard under their eaves of home	10	5.99
Total	167	100

Plate 4.3(a,b,c,d,e &f) demonstrated the different types of hives and their placement in the districts. Accordingly, traditional hives in open space, traditional hives hanged on big trees, tradit ional hives under temporarily shade or dase, traditional and modern hives hanged under the roof of residence house were some of the practices observed in the district.

Plate 4.3(a)Traditional hive in open space

Plate 4.3(b) Traditional hive on long tree

Plate 4.3(c).Traditional hives under simple shelter made for this purpose

Plate 4.3(d). Both traditional and modern hive under their eaves of home

Plate4.3 (e). Transitional hive

Plate 4.3(f). Modern and traditional hive under shelter

4.4 Response on Training given for the Beekeepers and Problem Faced by the Beekeepers

Table4.4 demonstrated that about 94.61% of the respondent did not take any kind of training. It is only about 5.39% of the respondent got training. Almost all beekeepers faced honey production problems.

Table 4.4: Response on training given for the beekeepers and problem faced the beekeepers in honey production

		Number of respondents n=167	Percentage
Have you got training on honey production?	Yes	9	5.39
	No	158	94.61
	Total	167	100
Have you ever faced problem in honey production?	Yes	167	100
	No	0	0
	Total	167	100

4.5 Response on limiting factors that affect honey production in Gechi district

All respondents were asked to list main limiting factors that affect honey production in the study area (Table4.5).Among all the limiting factors, the following were the major ones. About 40.72% of the honey was lost by; ants, spider, wax moth & birds, while 27.55%, 10.78%, 5.99% and 4.79% of the honey was lost by impact of traditional hives, lack of proper management for bees & hives, agrochemicals (herbicide& other pesticides) and deforestation, respectively. About 2.99% and 1.2% of the honey was wasted due to decline of bee colonies, shortage of bee food, improper harvesting time and monkey respectively. From these pests, the impacts of ants were a very serious problems in the study area. Farmers were commented on the mitigation methods of the limiting factors in honey production such as cleaning apiary site, placing the white ash around hive stand, covering the hive stand by plastic materials, avoiding bird nest around apiary site, making a hole around apiary site among others.

Table 4.5: Some of the limiting factors that affect honey production and mitigation methods

Limiting factors that affect honey production	Number of respondents and percentage n=167	Method to overcome the problem by the beekeepers
Impact of ants, spider, wax moth and birds	68(40.72%)	Cleaning apiary site, placing the white ash around hive stand, Covering the hive stand by plastic materials, Avoiding bird nest around apiary site, Making a hole around apiary site.
Traditional method of honey production	46(27.55%)	By converting traditional hives to modern bee hives.
Lack of proper management for bees and hives	18(10.78%)	Continuous monitoring of bees and hives/supervision
Herbicides/other Insecticides	10(5.99%)	Moving honeybee colonies from the spraying area, Removing the weed by hand. Using this chemical before the plant produce flowers.
Deforestation	8(4.79%)	Planting tree for bee forage, Conservation of plants
Decline of bee colonies	5(2.99%)	Leaving the larvae in hives during harvesting of honey, By leaving honeycomb in hives.
Shortage of bee food	5(2.99%)	Additional supplement of food for bees. Like powder of pea, beans, maize, berbere, sugar and water.
Improper harvesting time	5(2.99%)	Harvesting the honey on time.
Monkeys	2(1.2%)	Keeping the hives

4.6. Response on support given for the beekeepers by government to overcome some of the limiting factors in honey production

Majority of the respondents (97.6%) did not obtain any support from the government to overcome some of the limiting factors in honey production, but about 2.4% of the beekeepers had support from the government (Table4.6). Lack of material and financial support from the government for the beekeepers had its own impact on quantity and quality of honey produced.

Table 4.6: Response on support given for the beekeepers by government

Do you have supported from the government in honey production?	Number of respondents n=167	Percentage
Yes	4	2.4
No	163	97.6
Total	167	100

4.7 Respondents response on amount of honey they harvested per-year

Majority of the respondents (58.68%) harvested below 100kg of honey per year, while 35.33% and 5.99% of the respondents harvested 101 -200kg and 2001-300kg of honey per year, respectively (Table4.7).

Table 4.7: Response on amount of honey the beekeepers harvested per year

Amount of honey the beekeepers harvested per year in(kg)	Number of respondents n=167	Percentage
≤100	98	58.68
101-200	59	35.33
201-300	10	5.99
301-400	0	-
401-500	0	-
501-600	0	-
Above 600	0	-
Total	167	100

4.8 Response on pests that limit honey production in the study area and indigenous knowledge of the beekeepers to overcome the problems.

Table4.8 demonstrated the different variety of pests found in the study area. Among these; ants (*Formicidae*), beetles (*Aethina tumida*), waxmoth *(Galleria mellonella*), honeybadgr (*Mell ivora capensis),* spider *(Araneae),* lizard (*Lacertilia*), termite (*Isoptera*), bird (*Merops ornatus*) , monkey and snake *(serpentes*) with the proportion of 98.2%,79%,77.8%,23%,14.97%,12%,7.2 %,1.79% and 0.6% respectively.

Based on the result of this study the existence of pests were the major challenges to the beekeepers. In addition to this, the beekeepers said that there were different methods of controlling the pests that limit honey production in the study area. These were cleaning around apiary site, cleaning the hives and using white ashes as repellents of ants (Table4.8, plate4.4).

Table 4.8: Pests that limit honey production and indigenous knowledge about their management.

Pests that limit honey production	Number of respondents	The influence	Indigenous knowledge control mechanism
ANTS (*Formicidae*)	164(98.2 %)	Causes migration of bees from the hive, Eats the bee product	Placing ashes repellent around apiary site, destroying ant nests, covering hive stand by plastic materials.
BEETLES (*Aethina tumida*)-small beetle	132(79%)	Damage combs and comb content, disturb the bees, feeds honey	Narrowing hive entrance, Cleaning apiary site
WAX MOTH *(Galleria mellonella*)	130(77.8 %)	Eat and destroy the bees' wax.	Cleaning hives and apiary site.
HONEYBADGERS (*Mellivora capensis*)	39(23%)	Eat the honey, Causes destruction of hives.	Fencing around apiary site, narrowing of hive mouth.
SPIDERS (*Araneae*)	25(14.97 %)	Make the web around hives and catch the bee and eat	By removing spider web Cleaning apiary site
LIZARD (*Lacertilia*)	20(12%)	Eat the bee product	Killing by sharp materials
TERMITES (*Isoptera*)	12(7.2%)	Destruct the hives and hive stand.	By destroying termite home
BIRDS(bee-eater bird) (*Merops ornatus*)	12(7.2%)	These birds feed honeybee & decrease bee colonies.	Avoid bird nest around apiary site, by hunting and killing such kind of birds
MONKEYS	3(1.79%)	Destruct the hives, Eat the honey.	Keep the hives
SNAKE(*serpentes*)	1(0.6%)	Polluting the honey and disturb the bees	Killing by using sharp materials.

Plate 4.4 The hive stands covered by plastic materials to prevent ants and small mammals from honeybee.

4.9 plants species toxic to bees

As information was gathered from interviewed respondents, all most all respondents agreed with the presence of toxic plants in the district (Table 4.9,plate 4.5&4.6).These were, *Euphorbia catinifolia,Justica schimperiana, Nicotinia rustica &Phytolacca dodecandra* with the proportion of 90%,30%, 20% and 10% respectively.

Table 4.9: species of plants that are toxic to bees and bee products

Scientific name	Number of respondents n=10	Family	Local name (Afan Oromo)
Euphorbia catinifolia	9(90%)	Euphorbiaceae	Abaaboodiimaa
Justica schimperiana	3(30%)	Acanthacae	Dhummuugaa
Nicotinia rustica	2(20%)	Solanaceae	Tamboo
Phytolacca dodecandra	1(10%)	Phytolacaceae	Handoodee(endod)

Plate4.5and 4.6 shows Euphorbia *catinifolia* one of the toxic plants to honeybee found in the study area and the beekeepers used this toxic plant around apiary site to protect honey badger and monkey, respectively.

Plate 4.5 *Euphorbia catinifolia*-the toxic plant to honeybee found in the study area.

Plate 4.6 *Euphorbia catinifolia*- which surrounded around apiary site to protect honey badger& monkey.

CHAPTER FIVE

5. Discussion

Honey has high social, cultural and economic value 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 beeswax also play a big role in the 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 beekeepers were selected for collecting of data on 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 of the beekeepers were selected from total household beekeepers of six selected kebeles of 288 using Yemane (1967) sampling formula.

The age of the beekeeper is very essential to determine the type of agricultural activities engaged by the beekeepers. The mean ages of the respondents were 42.5 years. The range was 15 to 70 years. The report showed that majority of the beekeepers 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, 85.03% of the respondents were below 50 years old and 14.97% above 50 years old. This result agreed with the findings of Melaku(2005) who reported that the age groups between 15-60 years were considered as economically active age group. Similarly, Chala (2010) reported that the most productive age are actively involved being supported by experienced from elders and finally become independent beekeepers. The current findings also demonstrated that the sampled household beekeepers were male biased such that about 72.45% were males and 27.55% 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 relayed on traditional method and the traditional methods requires climbing of long tree to hang the 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 is 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 beekeepers about 53.9% did not attended the school and about 13.77% of the respondents took informal adult education, which enabled them to write and read somehow. Those households who got a chance to go to school grouped in into primary school, first cycle education and second cycle education with the proportion of 16.17%, 13.17% and 2.99%, respectively. Therefore, most of the beekeepers were unable to read and write. Education encourages beekeepers ability to access and use information relevant to honey production such as modern beekeeping, while uneducated individuals do not access such information. Education barrier brought about sticking to tradition practices by neglecting the modern practice, which ultimately lead to low production and productivity (Ajiao and Oladimeji, 2013). Similarly, Workneh (2011) reported that education increases the access to information and thereby raising knowledge of beekeepers regarding improved hive. The Dabessa and Belay (2015) reported similar literacy problem from Walmara district such that about 42.9% of the beekeepers cannot read and write which is in agreement with the current findings. Tessega (2009) reported different scenario from Burie district such that most beekeepers in Burie district can read and write.

Regarding suitableness of the district, all the respondents disclosed that Gechi district has suitable conditions for honey production because of its huge dense forest, large bee colonies, availability of food & water for the bees and suitable environmental conditions among others. Presence of dense forest increase availability of nectar and pollen for honeybee and the water is essential for honeybee consumption as well as for brood rearing and hive ventilation. In addition to this, bee colonies and suitable environments are the base for honey production. This study agreed with Nuru (2002) who reported that the availability of more honeybee forage results in high honey yield provided that other factors are also suitable for honey production.

Based on their level of technological advancement, three types of beehives were used by the sampled beekeeper farmers in the district. These were traditional, transitional and improved beehives. The result of the study showed that traditional hive was the leading (65.86%) type of beehive in Gechi district, while 4.79% & 26.34% were modern & mixed type(both traditional and modern hives), respectively. Few respondents (2.99%) used both transitional and traditional hives. The result showed that majority of the beekeepers were used traditional hives, because it's easy to construct, its cost effectiveness and less dependency on external input and also because of expensiveness and unavailability of modern beehives & accessories. This finding agrees with Nuru (2007) who reported that in Ethiopia, the type of beekeeping practiced is largely traditional which is being carried out in traditional hives of different types. Similarly, Gichora (2003) reported that in traditional honey production the hive condition, affect the honey, wax and bee colonies. However, these findings disagreed with Haftu *et al.,* (2015) who reported that about 41% of the beekeepers of the central zone of Tigray used both traditional and modern beehives and the rest 27.7%, 30.1% and 1.20% only owns traditional, modern and transitional beehives, respectively.

Regarding placement of hives the majority of the respondents (41.92%) placed their hives on long tree, while 21.55%, 30.54% and 5.99% of the respondents placed their hives on free open space, under simple shelter and under the eaves of home, respectively. The result of the study showed that the majority of the respondents' managements of their hives were very poor. For example, they placed their hives on long tree, backyard in open space and under simple shelter. Even cleaning of apiary site and arranging of hives under shelter is still very poor. The report showed that the beekeeper of the district did not care for the bee's health and the product harvested from the bee due to lack of management practices & carelessness. This result agreed with Nuru (2007) who reported that, lack of management practices and poor placement of the hives the annual average honey yield per colony is relatively low. Similarly, Tessega (2009) who reported that most of the beekeepers placed their honeybee colonies at back yard and inside the house.

Training is the backbone for the beekeepers to know how to operate modern honey production technology and to develop skill and knowledge of the beekeepers. Training can bridge technical gaps and equip the beekeepers with basic knowledge on how to operate improved hives and bee equipment, basic bee biology and honeybee colonies. Regarding training given for the beekeepers, majority of the respondents (94.61%) did not take any kind of training. It is only about 5.39% of the respondents got training. The report indicated that majority of the beekeepers 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.

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

The result of the study indicated that, there were a number of limiting factors that reduce amount of honey produced in the study area. From these, the major limiting factors were; impact of ants, spider, wax moth and birds, traditional method, lack of proper management for bees and hives, Herbicides /other insecticide and deforestation with the proportion of 40.72%, 27.55%, 10.78% 5.99% and 4.79%, respectively. About 2.99% and 1.2% of the honey was wasted due to decline of bee colonies, shortage of bee food, improper harvesting time and monkeys, respectively. From these pests, the impacts of ants were a very serious problem in the study area. Insect pests were the primary factors that limit honey production because they may cause total migration of bees from the 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 pest and predators for bees and their product. Similarly, Workneh(2011)reported the existence of these pests in Atsbi-Womberta 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 the respondents deforestation was carried out for different

purpose in study area like; for farmland, construction, charcoal and timber making. This causes shortage of bee food and decline of the number of bee colonies. 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 the products and honeybee population decline.

The woreda farmers are producing mainly teff, wheat, barley, chickpea and different horticultural crops. They use of chemical spray such as pesticide and other herbicide for pests and weed controlling has two disadvantages. Herbicide chemical destroys bee forage like herbs and shrubs, which is used as sources of pollen and nectar. The use of pesticides for protection of tsetse fly &mosquito directly kill honey bees and herbicides are not toxic to bee colonies but destroy many plants that are valuable to bees as sources of pollen and nectar. Examples of these chemicals are; Sevin, malathion, DDT, 2-4D and Acetone. Some of the beekeepers totally lost their bee colonies due to these agrochemicals (Kerealem et al., 2009). The beekeepers said that a number of bee colonies either die or absconded from their hive due to extensive use of agro-chemical in the district. This result agreed with Nuru(2007) who reported that agro-chemicals and deforestation reduce the number of honey bee colonies, which result low honey production. To overcome these problems the beekeepers used these chemicals far from apiary site. As the beekeepers said that, they did not properly know the time of harvesting of honey and they detected harvesting period by smelling and by observing the concentration of honeybee colonies around beehive entrance and the defensiveness of honeybee, which decline the economy of beekeepers.

Poor access to material and technical support is the factors that cause great challenge to the beekeepers who adopted improved honey production practices. Regarding support given for the beekeepers, majority of the respondents 97.6% did not obtain any support from the government to overcome some of the limiting factors in honey production, but about 2.4% of the beekeepers had support from government. Lack of beekeeping material and financial support from government for the beekeepers had its own impact on quantity and quality of honey produced. This result agrees with Haftu and Gezu (2014) who reported that farmers did not have any type of improved beekeeping equipment in Hadya Zone.

The result of the study showed that, majority of the respondents 58.68% harvested below 100kg of honey per year, while 35.33% and 5.99% of the respondents harvested 101-200kg and 2001-300kg of honey per year, respectively. This implies majority of the beekeepers did not harvest enough honey in the study area because they used traditional technology and due to impact of pests. This result agreed with Nuru (1999) who reported that low product and low quality of honey were the major economic impediments for the beekeepers. The respondents also said that, 5-10kg, 10-15kg and 18-25kg of honey were harvested from traditional, transitional and modern beehives, respectively based on availability of bee forage. However, they relayed 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 the study indicated that different varieties of pests were found in the study area, which challenges honeybee and reduce their product.Among those;ants (*Formicidae*), beetle (*Ae thina tumida*), waxmoth *(Galleria mellonella*), honeybadger (*Mellivora capensis),* spider *(Arane ae),* lizard (*Lacertilia*)*,* termite (*Isoptera*), bird *(Merops ornatus),* monkey and snake (*serpents*) wi th the proportion of 98.2%,79%,77.8%,23%,14.97%,12%,7.2% ,1.79% and 0.6%, respectively. Ants, beetles and wax moth significantly effect on honey yield since they highly limit the activity 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 bees, termite-destroy the hive 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 harmful pests and predators in order to decreasing importance of beekeeping in Amhara region .To mitigate the problems, the beekeepers had different methods of controlling the pests that limit honey production in the study area. These were cleaning around apiary site, cleaning the hives, using white ashes 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.

Honeybee 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; *Euphorbia catin ifolia, Justica schimperiana, Nicotinia rustica* & *Phytolacca dodecanda* with the proportion of 90%,30%, 20% and 10%, respectively. Beekeeper respondents reported that the red color flower plant called *Euphorbia catinifolia* was highly expanded in the study area, kills worker bees during flowering stages. 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 ‘’Acantha cae, Euphorbiaceae, Phytolacaceae, Solanaceae**,** Ranunculaceae & Plantaginaceae, “were the maj or flowering plants that affect honeybee and reduce their product. Similar result was reported by kerealem (2005) in which pollen or nectar of poisonous plants was toxic to the bees and those in which the honey produced from their nectar are toxic to humans.

CHAPTER SIX: CONCLUSION AND RECOMMENDATION

6.1 Conclusion

Gechi district has adequate natural resources and a long tradition and culture of honey production. However, the district and the rural beekeepers in general did not fully benefited from this apiculture sub sector. Because they used traditional method, lack of training, lack of material & technical support from concerned bodies. The finding revealed the major limiting factors in honey production in the study area. These were insect pests, traditional technology, lack of proper management for bees and hives, agrochemicals, deforestation, decline of bee colonies, shortage of bee food, improper harvesting time and monkeys.

The result of the study showed that majority of the rural beekeepers engaged in traditional method, because it is easy to construct, cost effectiveness than the modern beehives, which is very expensive. The finding of the study also shows that pests like ants, beetles, wax moth, spider, honey badger and lizards were limit honey production activities by consuming the honey and killing the bee colonies. In addition to this, improper placement of hives, lack of training &support, and poisonous plants to bees were also the factors that limit honey production in the study area. To mitigate the challenges, the beekeepers used their own indigenous knowledge to minimize some of the limiting factors by different mechanisms like cleaning 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. The study revealed that traditional, transitional and improved beehives were used by the beekeepers for honey production in the study area. The current study also showed that modern and transitional beehives give more honey production than traditional beehives. Despite all the limiting factors and challenges currently facing the beekeepers, there are still many opportunities and potential to improve the production system and quality of hive products. Like suitable climate, availability of bee flora, huge number of bee colonies and water.

6.2 Recommendations

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

1. Gechi district Livestock and Fishery Development Office should give enough attention by giving sufficient training and continuous assistance for the beekeepers.

2. Adequate supply of modern beehives, encouraging participation of households in honey production and increasing their bee product through reforestation and regular training on ways of mitigate the limiting factors.

3. The beekeepers should give attention for honey production activities in transferring traditional hives to modern beehives.

4. The district Livestock Office should encourage women participation in honey production through provision of training and modern beehives.

5. Increasing production and quality of honey by improving management practices, placement of beehives and environmental conservation.

6. Emphasis should be given to continuous training and support for farmer beekeepers on how to use modern honey production technology to enhance quantity and quality of honey.

7. The beekeepers able to alleviate the limiting factors through training, experience sharing and avoiding red flowers trees (*Euphorbia catinifolia*) from the area.

8. The beekeepers would use the biological method instead of chemical that affect the bee around apiary site, cleaning hives area and planting bee forage.

9. Developing indigenous knowledge in supporting by scientific method to control the limiting factors.

10. Other researcher may continue the research for further investigation on limiting factors 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, Zoology Department

Questionnaire

Dear respondent,

The purpose of this questionnaire is to collect data on Factors limiting Honey production in Gechi district,IluababorZone,Oromia Regional State,Ethiopia.

This questionnaire is filled out 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 (√) 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.

Tolesa Birhanu

Telephone: 0912112652

I. Personal information of the respondent

1. Kebele administration: _____

2. Age: 15-30 □ 31-50 □ above 50 □

3. Sex: Male □ Female □

4. Educational background

A. Did not attended school □

B. Can only Read & write only □

C. 1 – 4 □

D. 5 - 8 □

E. 9 -12 □

F. TVET/College □

G. University □

II. Questionnaires used to collect data on Honey production.

1. Does Gechi district have suitable conditions for honey production?

Yes □ No □

2.If your answer to question 1 above is yes, what are these suitable conditions?

A_____

B_____

C_____

D_____

3. Which type of hive do you use?

A. Traditional □

B. Modern □

C. Both □

D. Both tradition and transition □

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

A. Backyard in open space □

B. Backyard in open space on long trees □

C. Backyard under shelter made for this purpose □

D. Backyard under their home □

E. Any other specify _____

5.Have you ever got training on honey production?

A. Yes □ B. No □

6. If your answer to question 5 above is yes, list the benefits have you gained from the training.

A. _____

B. _____

C. _____

D_____

7. Have you ever faced problems in your honey production activities?

A. Yes □ B. No □

8. If your answer to question 7 above is Yes, list the problems you faced.

A. _____

B. _____

C. _____

D. _____

9.Select whether the following limiting factors affect honey production activities, estimate the % honey lost due to each, and mention measurements you use to overcome them if there is any

No.	The limiting factors that affect honey production	% yield loss	Control measures you used
9.1	Traditional method of honey production		
9.2	Wax mouth, ants, spiders and birds		
9.3	Decline of bee colonies		
9.4	Lack of proper management for bees and hives		
9.5	Monkey		
9.6	Insecticides/pesticides poisoning		
9.7	Shortage of bee botany/food		
9.8	Deforestation/habitat degradation		
9.10	Improper harvesting time		

10 Depending on question number 9 which limiting factor highly affect honey production?_____

11. Does the government give you support to overcome some of the limiting factors of honey production?

A. Yes □ B. No □

12.If your answer to question 11 above is Yes, list the support you got from the government.

A. _____

B. _____

C. _____

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

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

Appendix 2 Interview questions for other beekeepers

1. Do you have potential of honey production?

2. Is there any limiting factors that affect your honey?

3. Which factor is highly affecting you?

4. How do you overcome factors limiting honey production 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? How many?

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 no why?

11. What is your idea in the future to mitigate factors limiting honey production?

Appendix 3 Interview questions for the district livestock and fishery development office experts

1. Is there any potential of honey production in the district?
2. What are the major factors that limit honey production in the district?
3. Which factor becomes severe to the beekeeper?
4. Does the problem become identified in the districts?
5. What measurement to be taken by government to mitigate factors limiting honey production?
6. Is there a plant, which affects bee and their product in your districts?
7. Is that is enough bee products from the districts as compared to availability of natural resource?
8. If no enough honey in the districts, what is your commitment to prove the problem?
9. In the future to reduce factors limiting honey production and to change the lifestyle of beekeeper what kind of activities you plan?

8.2 Appendix-2 Some of the Sample of Respondents

8.3 Appendix 3 Lists of Some Honey Bee Floras in Gechi 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	*Guitozia abyssinica*	oil crop
Arbuu	*Ficus sur*	Tree
Boqqolloo	*Zea mays*	Crop
Atara	*Pisum sativum*	Crop
Muka arbaa	*Albizia 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	*Guizotias cabrascabra*	Herb
Reejjii	*Vernoia 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)