ADDIS ABABA UNIVERSITY

SCHOOL OF GRADUATE STUDIES

COLLEGE OF NATURAL AND COMPUTATIONAL SCIENCE DEPARTMENT OF ZOOLOGICAL SCIENCES

ASSESSMENT OF HONEY BEE (HYMENOPTERA: APIDAE*)* FOR HONEY PRODUCTION PRACTICES IN JIDDA WOREDA, NORTH SHOWA, OROMIA, ETHIOPIA

A THESIS SUBMITTED TO ADDIS ABABA UNIVERSITY MASTERS PROGRAM IN GENERAL BIOLOGY IN PARTIAL FULFILLIMRNT OF THE REQUIREMENTS FOR THE DEGREE OF MASTERS

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APPROVAL SHEET

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As member of the Board of Examiners of the Master of Sciences (M.Sc) thesis open defense examination, we have read and evaluated this thesis prepared by Tiruneh Wadajo entitled Assessment of Honeybee (Hymenoptera*:* Apidae) for honey Production Practices in Jidda Woreda, North Showa, Oromia,Ethiopia. We were certifying that, the thesis is accepted for fulfilling the requirements for the award of the degree of Master of Science in Biology.

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DEDICATION

This thesis manuscript is dedicated to my brother Megersa Wadajo and my mother Alamitu Fufa for nursing with affection and love and for their dedicated partnership in the success of my life.

STATEMENT OF AUTHOR

First, I declare that this thesis is my work and that all sources of materials used for this thesis have been duly acknowledged. This thesis has been submitted in partial fulfillment of the requirements for MSc degree at Addis Ababa University and is deposited at the University Library to be made available to borrowers under rules of the library, I solemnly declare that this thesis is not submitted to any other institution anywhere for the award of any academic degree, diploma, or certificate Brief quotations from this thesis are allowable without special permission provided that accurate acknowledgement of source is made. Requests for permission for extended quotation from or reproduction of this manuscript in whole or in part may be granted by the head of Biology department or the Dean of the School of Graduate Studies when in his or her judgment the proposed use of the material is in the interests of scholarship. In all other instances, however, permission must be obtained from the author.

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LIST OF ABBREVIATIONS/ACRONYMES

AM	*Apis-mellifera*
BK	Beekeeper
CSA	Central Statistical Agency
EARI	Ethiopian Agricultural Research Institute
FAO	Food and Agricultural Organization
Ha	Hectare
HBRC	Holeta Bee Research Center
HH	Head of theHousehold
JWARDO	Jidda Woreda Agricultural and Rural Development Office
MOARD	Ministry of Agricultural and Rural Development
NGO	Non-governmental Organization
PA	Peasant Association
SPSS	Statistical Package for Social Science
WAO	Woreda Agricultural Office
WARDO	Woreda Agricultural and Rural Development Office
WFEDO	Woreda Finance and Economic Development Office
WRLAO	Woreda Rural Land Administration Office

ABSTRACT

*The study was conducted to assess honeybee ((*Hymenoptera*:* Apidae*) for honey production practices in Jidda Woreda, North showa, Oromia, Ethiopia .Data were collected through semi-structured,interviews,and face to face discussions with the farmer and development agents;by making household and field observations,as well as through market surveys.The data collected was analyzed using descriptive statistics using Statistical Package for the Social Sciences (SPSS) version 20, The present study found out that of the total beekeepers/105/ interviewed 90 were married,5 were single,3 divorced and 3 windowed respectively.Concerning the type's beehives was discovered that 83 of the respondents refer traditional to transitional beehives. In the other hand, 12of the respondent showed that preference to transitional beehive, compared to 6 of the respondent who preferred modern bee hives.The present study showed that the time for honey havesting in Jidda Woreda was October to November with October as a peak harvesting mounth for obtaining the largest quantity and quality of honey. They said that the financial and labor inputs of farmers on beekeeping to bring the intended benefits. But this benefit depends up on the season of the year.The present study identified lack of knowledge and skilled manpower of the respondent, as well as lack of proper equipment, and prevalence of pest and predators (29.7%) as major constraints for honey production by small-holder farmer/spide,ant,honey badger,termites,bee eating and beetles. About (43.6%) of the respondents reported that honey production trend in the area decreased and (42.6%),(13.9%) reported increasing and unchanged trend of production system,respectively.we concludes that beekeeping brings substantial changes in the farmer's socioeconomic conditions by serving as alternative means of income generation. (24.8%), ants (22.8%),honey badger(17.8%)termites(10.9%).bee eating birds (7.9%), others(5.0%)and beetles 4(4,0%)*

Keywords: Agro ecology, Beekeepers, Honeybee colony, Honey production system in Jidda Woreda

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CHAPTER ONE

1. INTRODUCTION

1.1. BACK GROUND OF THE STUDY

Honey production is seen as a strategically important sector that should be supported in order to protect biodiversity and transfer it to next generations as it provide food security, increase diversity, support domestic economy by increasing employment, and prevent erosion threat (Yılmaz, 2015). Honeybees are essential organisms that contribute to global nutrition and food security and provide incalculable ecosystem services. Beekeeping or apiculture entails the rearing or keeping of bees with the aim of exploiting its products (such as honey, pollen grain, propolis, and brood) (Onwumere*et_ al*., 2012). The use and contribution of honey bee is diverse including honey, bee wax, queen, bee colonies, and other products such as pollen, royal jelly, bee venom and propolis in cosmetics and medicine. Additional role of beekeeping is pollination of food crops & many plants species used for conservation of the natural environment, and can be integrated with agricultural practices like crop production, animal husbandry & horticultural crops (Gezahegn Tadesse, 2001).

Recently the Ethiopia government is intensively working on land conservation in different parts of the country which is forming suitable condition for beekeeping and also organizing jobless urban and landless rural youth and women to engage them in bee equipment production and beekeeping activities.

Honeybee production is a long lasting practice in Ethiopia. As a result, beekeepers have developed indigenous technical knowledge on traditional hive construction from different locally available materials, on honeybee management practices like honey season identification, swarm catching and attractant methods, swarm control method, honeybee enemy protection; traditional methods of sting protection and reduction of pain Workneh Abebe (2006). More than one million households are estimated to keep bees using traditional, intermediate and modern hives (Gidey Yirga and Mekonen Teferi, 2010). Data from CSA (2006, 2008, and 2009) reports indicate that colonies in traditional beehives account for about 97% of the total hive honeybee population. The productivity of traditional hives is extremely low and the average yield is only about 5–8kg/per colony/per annum (MoARD, 2007). However, with this existing practices the annual honey production in the country is increasing and has reached quite higher than 53 thousand tons in 2012 (FAOSTAT data 2005; CSA, 2006; 2008; 2009, 2012).

Beekeeping is an important component of agriculture and rural development program in many countries. The role of beekeeping in providing nutritional, economic and ecological security to rural communities at the household level and is an additional income generating activity.This, being a non-land-based activity, does not compete with other resource demanding components of farming systems (FAO, 1990).

Useful small-scale efforts to encourage beekeeping interventions can be found throughout the world, helping people to strengthen livelihoods and ensuring maintenance of habitat andbiodiversity; strengthening livelihoods means helping people to become less vulnerable to poverty. Hence sustainable beekeeping seeks to address the importance of beekeeping in terms of its ecological, social and economic benefits. Within ecological dimensions, bees are a source of pollinators that help increase crop yields. The economic benefits lie within bee products such as honey, royal jelly, propilis bee pollen and beeswax that are highly valuable and have high market prices. But most importantly honey is a source of food with high nutrition value. In communities where beekeeping is done for commercial purposes, it has led to selfreliance through the innovation of local industries associated with the production of beekeeping equipment and bee products (Bradbear, 2003).

Crane (1990), as he reported, honeybee production practice is floral based industry and bees wholly depend on plants for their food; and from 250000 plants in the world, about 40000 plant species are important for honey bee as a food source. Bee colony performance as well as production of honey, wax and other hive products depends on bee forage plants from which honey bees obtain nectar and pollen as main food. These food sources provide the nutritional requirements of the bee colonies: nectar as sources of honey provides heat and energy for honey bees and pollen provides protein, vitamins, fatty substance, and other nutrients (Amsalu Bezabeh, (2000).

Owing to its varied ecological and climatic conditions, the country is home to some of themost diverse flora and fauna in Africa, making it highly suitable for sustaining a large number of bee colonies (Nuru Adgaba, 2007). The country has the largest bee population in Africa with over 10 million bee colonies, out of which about 7.5 million are confined in hives and the remaining exist in the forest (Nuru Adgaba, 2007). This makes the country one of the largest honey producers and the 3rd largest beeswax producers worldwide. Ethiopians honey production accounts for approximately 2.48% of the world production and 21.73% of African honey production (EARO, 2000; MoARD, 2007).

In Ethiopia, there are generally two honey harvesting seasons: the major one that lasts 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 type of flowering plants and rainfall patterns in different agro ecologies (Adgaba Nuru, 2007), which experienced beekeepers and local people easily associate the harvesting season with the botanical origin of honey in their locality (Legesse Negash, 2013).

Based on the level of technological advancements, three types of beehives (traditional, intermediate and frame hives) are used for honey production in Ethiopia. Despite the long beekeeping tradition in Ethiopia, the highest bee density, being the leading honey producer and one of the largest beeswax exporting countries in Africa, the share of the sub-sector to the Gross Domestic Product (GDP) of the country has never been commensurate with the huge resources and the country's potential for beekeeping.

In recent years, the contributions of beekeeping in poverty reduction, sustainable development and conservation of natural resources have been recognized and well emphasized by the government of Ethiopia and Non-Governmental Organizations (NGOs). As the country is endowed with varied ecological zones and different flora, there is a great potential in the country for working with communities by introducing simple and easily adaptable apiculture production systems that will lead to considerable gains in productivity beyond family consumption needs (MoARD, 2007).However, to date, there is nopublished information on honeybee production practices in Jidda woreda.

1.2. Statement of the problem

Beekeeping by its nature doesn’t need huge investment (financial asset), large size of land and complicated technical knowledge. Further, the outcomes of beekeeping (income, material goods, wellbeing and satisfaction) are real (Nicola, 2009). Beekeeping strengths and supports the rural community livelihoods to become less vulnerable to different shocks and avert risks. However, the individual poor beekeeping farmers in particular and the country in general still could not harvest honey to the required amount which in turn income from this sector to the producer, trader and the country is generally low in honey. Of the total honey production in Ethiopia, about 41.22% was used for household consumption, about 54.68% for sale, about 0.34% used as payment for wage in kind and the rest (3.75%) used for other purposes (CSA, 2015). In the matter, for better understand of unexploited economic potential of the apicultural resources in a sustainable way as well as to upgrade and to promote beekeeping in the study areas, it is timely and relevant to conduct appropriate beekeeping research program to investigate major constraints and opportunities as well as to come up with possible recommendations as such types of study has not yet been carried out in the study region.

1.3. Objectives of the study

1.3.1. General Objective

The general objective of this study was to assess the overall honeybee production activities in the Jidda Woreda, North Showa', Oromia, Ethiopia

1.3.2. Specific Objectives to:-

- Assess honey production systems, productivity, apiculture/keeping/potentials and opportunities of beekeeping**,**
- Evaluate major constraints of honey bee production practices in the study area,
- Assess beekeepers livelihood system in the study area, and
- Identify the material that is being used for hive construction in study area

1.4. Basic Research Question

This study will answer the following basic research questions:-

- What type of honeybee production system present in the study area?
- What are the major materials used for hive construction in the study area?
- What are the major pests and predators found in the area that threat your colonies?
- What measures do you take to protect bee colonies from agrochemical/chemical?
- What possible suggestions could be drawn as a solution for honeybee production in the study area?

1.5. Significance of the Study

Policy makers, non-governmental organizations and donor agencies in Ethiopia have been trying for decades with how to design and implement honeybee production intervention programs and projects in order to improve the beekeeping sub sector and thereby raise household economic issues. The study will help to improve our understanding of honeybee production systems, production potential and constraints of beekeeping sub sector useful to help policy makers develop appropriate beekeeping development strategy plan and indicate future research areas for those who will like to conduct researches on beekeeping.

CHAPTER TWO

2. LITERATURE REVIEW

2.1. Role of Beekeeping

Beekeeping is an applied science and art of rearing honeybee colonies for man's economic benefits (Qaiser *et al.*, 2013). Studies show that the beekeeping have many products like honey and its product/royal jelly, beeswax etc (Koshiyama *et al.*, 2011),contributes cash income for beekeeper's (Mwakatobe and Machumu, 2008),to poverty reduction, sustainable rural development and natural resources conservation (Ogaba, 2010; Tewodros Alemu, 2010; Shehadeh, 2012). Additionally, countries earn foreign exchange from export of bee products (Bradbear, 2009; Meaza Gebreyohannes, 2010).

The majority of Ethiopians live in rural areas depending on agriculture as their sources of livelihood and apiculture is one of an important agricultural activity in most rural areas. As beekeeping has low start up cost and requires little land and lab our, it is accessible to many rural communities and is promoted as a pro-poor income generation activity (MoARD, 2007). It have been exercised as a sideline activity by many of the rural farming communities for its honey and beeswax production that contributes to income generation. Beekeeping is one of the most important income-generating activities in the rural communities. Many resource poor farmers sell their honey to the local markets and use income to purchase livestock, agricultural inputs, food crops and other household items (Kerealem Ejigu et al., 2009).

2.2. Honeybee Reproductive System

The existing queen bee in the hive lays two types of eggs. One is a fertilized egg that has genes produced from both parents while, the second type is infertile egg which has no combination of male parent gene. In the process of completing the metamorphosis cycle four stages are involved; the egg, larva, pupa and finally the adult bee. The queen bee after being an adult stays in a hive for five days or so and then matures to accept drones for mating outside the hive in the air. Prior to her nuptial flight, she produces attractant pheromone and all male bees receiving the scent would make search for her in the air. The mating opportunity and her needs to have more drone bees mating depend on the availability of potential food stored and amicable weather conditions. Research results indicate that within two or three days virgin queen bee could make mating with several drones even up to twenty.After mating is completed within three days the queen bee stays in the hive and start layingeggs.This is the normal and usual reproductive phenomenon. Sperm cells ejaculated by drone bees are stored in the spermatheca of the mated

queen bee. These cells are adequate for the rest of her life time (Amsalu Bezabeh and Desalegn Begna, 2001).

Metamorphosis cycle and development processes as the eggs are laid and deposited in comb cells; they would stay as eggs for three consecutive days but with some changes in positions. On the fourth day they will be changed into larvae. That is the first day of larval development. From this time on wards the larvae start eating food. For the first two to three days feeding of royal jelly for all larval types in the comb is a must. Fortunately, however, the larva destined to become a queen bee would be provided royaljelly without interruption. If not else the worker bees will dismantle the former comb cell and construct new queen cell cup while the selected queen's larva is still in the former cell cup. Larval feeding for worker and drone bees would be disrupted and change of food type for continuous feeding, with less nutritious food instead of royal jelly. The lesson learnt here is that worker bees in the hive can convert fertilized eggs to queen bees as long as fresh larva is present in comb cells (Tessega Belie, 2009).

2.3. Honeybee Species, Sub-species and Their distribution in Ethiopia

The honeybees are oneofthe species that have the ability to exist in different agro-ecological zones. The original honeybees were found in Asia, Europe and Africa. As a result of human migration these honeybees have now migrated to the new world of Americans, Australia and New eland. Therefore, it is possible to find honeybees in all corners of the world except the polar zones. So far there are about seven identified species of honeybees in the world. Moreover there could be more unidentified species of honey bees. The honeybee species found in Ethiopia is called Apis mellifera. The original places for this species were Africa and Europe, but now it is well bred, multiplied and distributed to the whole world and there is no place on our planet where Apis mellifera is not found. It quickly adapts to varying weather conditions, soil, foraging plants and to the changing environmental conditions. Hence, it is favored by most people of the world. It is obviously true that the impact of different geographical features change the color of honeybee's productivity, production potential, character, and behavior resistance to climate stress, diseases and on various unforeseen incidences.In order that, Apis mellifera has all the important characteristics preferred by humans. In Africa, several sub-species of bees are found in different geographical locations. Investigation of the sub-species in Africa was started by pioneer researchers in 1804, 1990 and in 2000/G.C/. In Ethiopia, the existence of five sub-species namely *Apis mellifera scutellata, Apis mellifera monticoloa, Apis mellifera jementica, Apis mellifera woyi Gambela,* and *Apis mellifera* bandasi are verified.

Since the late 1700s about 9 species of honeybees have been recognized (Roubik, 1989).These is *Apis andreniformis, Apis cerana, Apis cerana indica, Apis dorsata, Apis dorsata binghami, Apis florea, Apis laboriosa, Apis mellifera* and *Apis vechti.* Among these the following are the major honeybee species: *Apis cerana*/*indica*, *Apis dorsata*, *Apis florea* and *Apis mellifera*. About 20,000 bee species collect nectar, convert *into* honey and store as a food source. Only honey bees that live together in large colonies store appreciable quantities of honey; these include bees of the genera *Apis* (honeybees), *Trigona* and *Melipona* (stingless bees) that people have recognized throughout the ages as sources of honey (Bradbear, 2003). Among the four commonly-recognized species of *Apis,* only *Apis cerana* and *Apis mellifera* are kept commercially by man. Behavioral limitations of the dwarf and giant honeybees, particularly their practice of open-air nesting, prevents their being kept in man-made hive for reasonably long periods, while hiving colonies in specially-constructed containers is essential in that it enables the colonies to be manipulated (FAO, 1990). 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). African bees are much more active in collecting nectar than temperate-zone bees. They produce wax readily, possibly in response to their need to build new combs frequently. They are very adapted and can live in tropical climates ranging from semi desert to tropical rain forests.

2.4. Important Races of Honeybee

Bees that produce enough honey to be worth harvesting belong to the two sub families of the family *Apidae*: *Apinae* (honeybees) and *Meliponinae* (stingless bees). *Apinae* has only onegenus, *Apis*, and about nine species of which the *Apis mellifera* species is of much greatereconomic importance than any others.*Apis mellifer* ('honey- making bee') is one of the most successful species in animal kingdom. It became more adapted to wide range of environmental condition to a greater extent: one and the same species is able to survive in semi desert tropical regions as well as in cold-temperate zones (Ruttner, 1986). The races and strains of Apismellifera are overriding world importance in beekeeping, and are the basis of world's beekeeping industry. European Apismellifera is the bee first studied, and it still receives by far the most attention. Apisdorsata and Apisflorea are confined to tropical Asia, and each species builds a single comb in the open, unprotected or semi-sheltered area. Apiscerana and Apismellifera live in the Old World tropics, but during evolutionary times they succeeded in spreading in to the north temperate zone of the Old World. Each builds a nest in a cavity, consista number of parallel vertical combs.

2.5. Honeybee products

Beekeeping provides an excellent bonus to humans because only bees are capable of harvesting nectar and pollen that otherwise would be inaccessible to people (Adjare, 1990; Bradbear, 2003;

Melaku Girma *et al.*, 2008; Tewodros Alemu, 2010). When the honeybee produces non-perishable marketable commodities, beekeeping is said to be essential economic sector, which directly contributes in the values of the outputs like honey, beeswax, queen and bee colonies, pollen, royal jelly, bee venom, and propolis in cosmetics and medicine (Adjare, 1990; Workneh Abebe, 2007).

2.5.1. Honey and Beeswax

Honey is the most important primary product of beekeeping. The bees collect from the nectar of plants (mainly composed of complex mixture of carbohydrates) by reducing the water content, store and leave it in honeycombs or honey pots to ripen and mature for their own consumption (Gebreegziabher Gebremedhin *et al.*, 2013; Oyerinde *et al.*, 2014).

Next to honey, beeswax is an important bee product secreted from the wax gland of bee workers (Boukraâ *et al*, 2013). It is a mixture of esters, fatty acids, higher alcohols and saturated hydrocarbons in addition to aromatic substances and pigments (Ghanem, 2011). Beeswax is one of the most valuable and oldest bee products to be used by mankind (Nuru and Adgabe, 2007; Ayalew Kassaye, 2008; Gemechis Legesse, 2014) and still being used in various fields such as cosmetics, foods, pharmaceuticals, engineering and industry (Gemechis Legesse, 2014).

2.5.2. Pollen and Propolis

Pollen contains the male gametophytes (Bogdanov, 2015). Pollination occurs when pollen is moved within flowers or carried from one flower to another of the same species by bees and other pollinators (Akangaamkum *et al.*, 2010). Pollen can be collected by pollen trap from the hive entrance or inside the hive from the comb cells and used as a dietary supplement and has a history in traditional medicine (CBI, 2009). Pollen is the bees' main source of proteins, minerals, fats and other substances (Bogdanov, 2015).

Propolis is a resinous substance collected from plant sap and resins (Segeren, 2004; Tsutsumi and Oishi, 2010) to seal cracks, reduce openings, and strengthen the base of comb attachment (Bradbear, 2003; Tsutsumi and Oishi, 2010). Propolis displays strong wide spectrum antimicrobial activity and has been used as a chemotherapeutic agent since ancient times and still used as treatment agent for numerous diseases including veterinary medication (Bogdanov, 2015a). Its treatment is under study for HIV and cancer (Tsutsumi and Oishi, 2010).

2.5.3. Royal jelly

Royal jelly or 'bee milk' is a thick milky white liquid substance derived from the pharyngeal glands of the honeybee that feeds bee larvae. Besides,predominantly valued as a medicine, bio-stimulating, immuno-modulating effects and anti-aging activity for human beings (Bogdanov,

2015). The effect of the royal jelly on the human organism in prevention, prophylaxis and treatment is proved (Menkovska, 2013). Since Royal Jelly is the only food that queen bees take, and because a queen lay over 2,000 fertile eggs in a single day, it must be highly rich in nutrients (Alive and Well, 2014).So, royal jelly helps as diet and prophylactics that it influences different systems of the body as, cardiovascular, nervous system, heart and blood circulation, respiration, and is more 7 efficient in curing diabetes, cancer, infertility, wounds (Folayan and Bifarin, 2013; Bogdanov, 2015) asthma, hay fever, liver disease, pancreatitis, sleep troubles (insomnia), premenstrual syndrome (PMS), stomach ulcers, kidney disease, bone fractures, menopausal symptoms, skin disorders, and high cholesterol. It is also used as a general health tonic, for fighting the effects of aging, and for boosting the immune system (WebMD, 2015).

2.5.4. Bee Venom

Honeybee venom, produced by a pair of glands near the sting apparatus in worker bees (Tsutsumi and Oishi, 2010), is useful for treatment of rheumatism, eye and skin diseases (Folayan and Bifarin, 2013) it contains several physiologically active components.like phospholipase A2, hyaluronidase, acid phosphomonoesterase, α-D-glucosidase, and lysophospholipase (Boukraâ *et al*., 2013).

2.6. Overview of honeybee production in Ethiopia

In Ethiopia, beekeeping has been a tradition since long before other farming systems (Gezahegne Tadesse, 1996). Although it is one of the important and the oldest farming activities in the country, there are no available records, which confirm when and where beekeeping was first started. However, the Hieroglyphs of ancient Egypt refer to Abyssinia (ancient name of Ethiopia), as source of honey and beeswax and Abyssinia has been known for its beeswax export to Egypt for centuries when other items were not exported. It is, thus, assumed that the keeping of bees in baskets may have started about 5000 years ago in the northern regions along with the early settlements. No countries in the world may have ancient beekeeping as Ethiopia (Fichtl and Admassu Addi, 1994; Gezahegne Tadesse, 2001b). Additionally, the oldest basket hive in the International bee museum is from Ethiopia.

2.6.1. Beekeeping and Honey Bee Production Practices in Ethiopia

As much as morphosmetric analyses of Ethiopian honeybees are concerned, Smith (1961) reported Apis mellifera monticola from the Ethiopian plateaus and later, Ruttner (1975) reported the presence of Apis mellifera scutellata and Apis mellifera jemenitica. Ayalew Kassaye (1990) recommended the existence of five honeybee races: Apis mellifera jemenitica (in eastern lowlands), *Apis mellifera monticola* (in the southern mountains), *Apis mellifera litorea* (in the

extreme western low lands), *Apis mellifera adansonii* (in the southern mid-altitude areas) and *Apis mellifera abyssinica* (central plateau and southwestern parts of tropical forest). Radloff and Hepburn (1997) recorded *Apis mellifera jemenitica, Apis mellifera band asii* and *Apis mellifera sudanensis* from Ethiopia. Additionally, these findings are inconsistent except for *Apis mellifera monticola* and *Apismellifera jemenitica* and none of the results indicated the distribution, behavior and biology of these honeybees for the whole of Ethiopia (Amssalu Bezabeh, 2002). It shows that there should be additional efforts to characterize in details and delineate the geographical distribution of the bee races.

Oromia region has three geographical races of honeybees (*Apis mellifera jemenitica, Apis mellifera scutellata* and *Apis mellifera woyi Gambela*) are reported to exist in different ecological zones of the region (Amssalu Bezabeh, 2002).Therefore, *Apis mellifera scutellata*is widely distributed in the region. Behaviorally, the migratory tendency of scutellata is very low.

2.6.2. Geographical Distribution of Ethiopian Honeybees

In Ethiopia, beekeeping has been a tradition since long before other farming systems (Gezahegne Tadesse, 1996). Even if it is one of the important and the oldest farming activities incountry, there are no available records, which confirm when and where beekeeping was first started. However, the Hieroglyphs of ancient Egypt refer to Abyssinia (ancient name of Ethiopia), as source of honey and beeswax and Abyssinia has been known for its beeswax export to Egypt for centuries when other items were not exported. No countries in the world may have to ancient beekeeping as Ethiopia (Fichtl and Admassu Bezabeh, 1994; Gezahegne Tadesse, 2001a). Additionally, the oldest basket hive in the International bee museum is from Ethiopia. Apiculture is practiced as an integral part of farming activities. It is also a source of additional income for urban communities. Other than areas with extreme climatic conditions, beekeeping is common in every village and at virtually all smallholder farms. Total honey production in 2008/9 is estimated at 39,650 tons and there are three different hive types by which the honey is produced: traditional, transitional (intermediate) and movable frame hives. There are 5,013,848 traditional, 34,552 transitional and 100,843 frames hives in Ethiopia (GDS, 2009). Ninety-three percent of honey production comes from traditional hives. Oromiya, Amhara, Southern National Nationalities and People (SNNP), and Tigray are the major honey producing regions with production quantities of 15,492 tons, 10,834 tons, 5, 847 tons an 3904.6 tons, respectively, (GDS, 2009).

2.6.3. Beekeeping production system in Ethiopia

Ethiopia is blessed with adequate water resources and various honeybee floras, which create fertile ground for the development of beekeeping. Honey hunting and beekeeping have been practiced in the country for the exploitation of honey. In places where wild colonies of bees

living in hollow trees and caves are found, honey hunting is still a common practice in Ethiopia (Tessega Belies, 2009). As Ayalew Kassaye stated that (2008), currently in Ethiopia beekeeping is practiced in three types of production systems namely; traditional, transitional and frame beehive beekeeping..Three types of beekeeping production systems in used by the beekeepers in the country, namely the traditional, transitional (intermediate) and modern hive (frame).

2.6.3.1. Traditional Beekeeping

Traditional beekeeping is the oldest and the richest practice, which has been carried out by the people for thousands of years in Ethiopia. This beekeeping practice is extensive and closely tied to swarm management: beehives are hung up in trees to catch swarms and are then transferred and placed in the backyards with some kinds of hive sheds that protects them from the hot temperature and rain. Traditional beehives (30-40 cm across and 1 m long) are crafted by creating a tube shaped structure using branches, straw, cow dung and clay. But, sometimes hives can be made from soft logs of a cactus tree (Gallmann and Thomas, 2012). Hence, several million bee colonies are managed in these kinds of hives and traditional beekeeping methods in almost all parts of the country (Fichtl and Admasu Addi, 1994).

Asreportedby, Beyene Tadesse and David (2007) under Ethiopian farmers' management condition, the average amount of crude honey produced from a traditional beehive is estimated to be 8 to 15 kg per harvest/beehive/year in which about 8-10% of its weight is beeswax. However, this harvest is achieved with minimal cost and labor, which is valuable to people living a marginal existence (Tessega Belie, 2009). This beekeeping practice may differ from place to place and beekeeper to beekeeper based on the resources and knowledge in the area. Accordingly, two types of traditional beekeeping practices are found in the country (forest beekeeping and backyard beekeeping). In some places, especially in the western and southern parts of the country, forest beekeeping is widely practiced by hunging a number of traditional beehives on the trees. In the other most parts of the country, backyard beekeeping with relatively better management is the common and dominant type of beekeeping (Nuru Adgaba, 2002; Gallmann and Thomas, 2012). Up to about ten; thus, they can be managed for honey production and for Crop Pollination**.** Tropical subspecies of Apismellifera are smaller than temperate zone subspecies, and they have a more slender alerted to sting and this characteristic allows their survival in the African tropics where they were liable to be attacked by many 'enemies' (Crane, 1990).

2.6.3.2. Transitional beekeeping

Beekeeping using transitional hives introduces a frame bee ways of producing quality honey and harvesting more than what they could produce from a traditional hive. This type of hive is a long trough-shaped with sloping sidewalls covered with top bars of a specified width. Transitional hives can be made from timber or from any other locally available materials internally plastered by mud and animal dung (SC-UK, 2006). As the bars are moveable, it allows internal inspection with little disturbances to the bees and the constructed combs. Also, its size (volume) is larger than most of the traditional beehives.

Transitional hives have a higher honey yield over the traditional hives as well as mechanism for monitoring the maturity of honey thus enabling harvest at optimal time. Moreover, the ratio of honey to beeswax produced for transitional hives is similar to that of traditional hives (approximately 90:10). Being a relatively recent introduction to Ethiopia, the total number of transitional hives in the country is quite low: approximately 34,552 hives. Transitional hives are being predominantly promoted in Oromia, Amhara and SNNP regions which have 38.3%, 30.2% and 18.8% respectively of the total number of these hives. This is attributed to the increased and continuous training provided to the beekeepers by some NGOs and the development agents (DAs). Productivity of transitional beehives is 14 kg/hive in Oromia and 13.4 kg/hive in SNNP. Honey from transitional hives is suitable for industrial processing into table honey for local and export markets.Transitional hives made from bamboo, on the other hand, cost on average approximately ETB 69.30 (US$5.54)/hive with maximum service life of only three years (GDS, 2009).

2.6.3.3 Moveable frame hive/modern hive

Moveable frame beehive beekeeping was introduced to the country in 1978, through the Ethiopian Rural Development Extension program (HBRC, 1997). Movable frame hives allow common management practices aimed at increased honey yield directly through reducing colony migration, adding supers and regular harvesting or indirectly by stimulating early colony growth, swarm control, feeding during off-season and pest and disease controlling. The productivity of frame beehives ranges between 20 and 30kg/hive/annum), which is much higher than that of the other hive types. The yield creates high motivation for its adoption provided. But strict bee and honey management technique and accessing market would be essential requirements for success and continuous adoption (SC-UK, 2006).

Frame hives are good for honey production but have the lowest beeswax production at only 1-2% of the honey produced. Since honey from frame hives is suitable for production of table honey both for local and export markets, it is currently being promoted vigorously by the

government and a number of private sector processors who have integrated farms. However, since the honey and beeswax subsectors only recently have received increased attention from the government and some NGOs, the total number of frame hives stands at 100,843. The total honey produced from frame hives in year 2008/9 is estimated at 2,149,284kg. This amount contributes by 5.4% towards the total honey production in the country (GDS, 2009). The distribution of the frame hives in other regions is quite insignificant except in Oromia region which has 14.3% of the total frame hives in the country. The annual productivity of frame hives generally falls within the range of 30 – 45kg/hive (GDS, 2009). The amount of beeswax produced is 1-2% of the honey yield (Gezahegne, 2001b) but in potential areas up to 50-60 kg harvest has been reported by HBRC (1997).

2.6.4. Socio-economic importance of Honeybee production

According to Bradbear, 2003 honey has value as a food, as a medicine, as a cash crop for both domestic and export markets and as an important part of some cultural traditions. Beekeeping has been and still plays a significant role in the national economy of the country as well as for the subsistence smallholder farmers. In addition the contribution of bees and hive products, though difficult to assess, is probably one of the most important small-scale income generating activities for hundred thousands of farmer beekeepers. In this case, we consider that beekeeping has many advantages that help farmer beekeepers to improve their wellbeing.

2.6.4.1. Honey Production and Benefits of honey

- **Easily digested:** Because sugar molecules in honey can convert into other sugars (e.g. fructose to glucose), honey is easily digested by the most sensitive stomachs, despite its high acid content. It helps kidneys and intestines to function better.
- **Good source of antioxidants:** It plays a big role in the prevention of cancer as well as heartdisease.
- **Has a low calorie level:** Another quality of honey is that, when it is compared with the sameamount of sugar, it gives 40% less calories to the body. Although it gives great energy to thebody, it does not add weight.
- **Rapidly diffuses through the blood:** When accompanied by mild water, honey diffuses into the bloodstream in 7 minutes. Its free sugar molecules make the brain function better since the brain is the largest consumer of sugar, thus, reduces fatigue.
- S**upports blood formation:** Honey provides an important part of the energy needed by the body. For blood formation. In addition, it helps in cleansing the blood. It has some positive effects in regulating and facilitating blood circulation. It also functions as a protection against capillaryproblems and arteriosclerosis (Medical Journal, 1986).

- **Does not accommodate bacteria:** This bactericide (bacteria-killing) property of honey is named "the inhibition effect". Experiments conducted on honey show that its bactericide properties increase twofold when diluted with water. It is very interesting to note that newly born bees in the colony are nourished with diluted honey by the bees responsible for their supervision - as if they know this feature of the honey (Medical Journal, 1986).
- **Royal jelly:** Royal jelly is a substance produced by worker bees inside the beehive. Inside this nutritious substance are sugar, proteins, fats and many vitamins. It is used in problems caused by tissue deficiency or body frailty (Medical Journal, 1986).

In Ethiopia the largest part of the honey is used to brew *tej*, a local kind of honey-wine. Also different kinds of honey-beers can be brewed. For those who prefer non-alcoholic drinks, honey is a tasteful sweetener of juices, cocktails and teas. Ethiopians´ make a popular soft drink made out of honey is '*birz',* which is consumed as a delicacy during religious festivities (Jacobs *et al*., 2006). Honey's main features depend on the floral origin or the nectar source foraged by the honeybees. The composition and quality of honey also depends on environmental and other factors associated with production, such as weather, humidity inside the beehive, nectar conditions, and treatment of honey during extraction and storage, (Tchoumboue *et al*., 2007). Moreover, honey is exportable crop. According to Nicola (2004), most developed countries import honey to meet such demand.

2.6.4.2. Beeswax Production

In-several regions of the country, beeswax collection is not significant and the beeswax produced by bees, which could be harvested by beekeepers, is wasted. The wax is mostly left or thrown away because beekeepers do not bother to collect it since it is of little practical value for beekeepers (Fichtl and Admasu Adi, 1994) and the people do not know the local beeswax is generating attractive money. Nevertheless**,** the annual bees wax production of the country is estimated at about 3,658 tones (AMP, 2007).This makes Ethiopia the fourth largest beeswax producing country in the world after China, Mexico and Turkey. Beeswax supports the national economy through foreign exchange earnings. Presently, beeswax is one of the major exportable agricultural products. Ethiopia is the third largest beeswax exporter in Africa and the annual average value of beeswax is estimated at about 125 million Birr (Nuru Adgaba, 2002). Like honey, beeswax is also a multipurpose natural bee product, which is used in the manufacture of more than 300 commodities. Honey and beeswax also play a big role in the cultural and religious life of the people of the country.

2.6.4.3. Crop Pollination

Bees are essential parts of the agricultural system. Although the value of honeybees in crop pollination is under estimated, it has a significant role in increasing national food production and regeneration of plant species. Honeybees are the prime pollinating agents in the world. Their service in pollination is estimated to be worth over 15 times the value of all hive products together, although it is much more difficult to quantify their benefit (EARO, 2002; Hackett, 2004).

2.6.4.4. Source of Income/cash

Beekeeping is believed to play a significant role and one of the possible options to the smallholder farmers in order to sustain their livelihood. It does not only serve as a source of additional income, but also quite a number of people entirely depend on beekeeping and honey selling for their livelihoods Adgaba Nuru (2002) indicated that honeybee and their products provide direct cash income for beekeepers. In areas where honey production is not attractive, beekeepers can sell their colonies in the market. In this regard honeybees serve as 'near cash' capital which generate attractive money. In Tigray, the price of one established bee colony in a traditional hive ranged from 300-800 Birr (Nuru Adgaba, 2002), which was worth enough to buy about 3-5 sheep and goats or a heifer. On the other hand, some beekeepers in Amara region that are involved in beekeeping technology packages, were reported to earn up to 3000 birr annually from sale of honey (BOA, 2003b), making up for the large portion of their annual income. This indicates the high potentiality of beekeeping as a source and means of diversification of income for the rural communities. In Jima Zone of Oromia Regional State, farmer beekeepers are reported to earn up to 40,000 birr/annum. In some tribes the entire livelihood of a community solely depends on honey selling. Many speakers reminded the African honey trade workshop that export is not always the bestidea. The domestic and regional honey markets are currently under saturated in countries such as Kenya and Uganda; which is sound for Ethiopia, where urban supermarkets, hotels and otherretail outlets provide opportunities for honey sales. The advantages of selling locally include:lower marketing and transaction costs, less stringent quality criteria, less stringent certification requirements, easier to sell without any special marketing approach, fewer consequences if supplies are erratic and small volumes are acceptable.

Fresh local honey is always more highly valued than imported honey. Many beekeepers sell their product directly to consumers. Honey is often used as a barter commodity in villages, especially in remote areas or areas isolated by war or sanctions. Honey is a stable commodity

with a long shelf life. If harvested carefully, it will remain wholesome for many years. As standards of livingrise, honey consumption increases (Bradbear, 2003).

Most industrialized countries import honey to meet demand. This requirement can providedeveloping countries with a useful source of foreign exchange from honey exports. All developing countries can export honey if production is in excess of local requirements. Because beekeeping does not use land, production of honey for export need not conflict with growing crops for local consumption (Bradbear, 2003).

2.6.5. Honey Bee Feed Source

Plants are the food source of honey bees (Gezahagn Tadesse, 2007). However, not all plants an important for honeybees, and those plants that supply both nectar and pollen abundantly when in bloom and these are often called honeybee plants (Akratanakul, 1990); honey bee plants are best suited for honey production as well as colony maintenance, in that bees obtain protein from pollen source plants and carbohydrate from nectar source plants (Bista and shivakoti, 2001). Honeybees with their activity of extending their proboscis into the flowers are considered as nectar source and bees carrying pollen on their hind legs were determined as pollen source (Mbah and Amao, 2004).

Floral calendar for beekeeping is a time-table that indicates to the beekeeper; the approximate date and duration of the blossoming periods of the important honey and pollen plants (Diver 2002). When we see the flowering time of single *species*, it begins from the full opening of the first few buds till the start of fruit formation end of flowering (Liseki and Boniphace, 2008*).* The distribution and type of honeybee plants as well as their flowering duration vary from one place to another place due to variation in topography, climate, and farming practices. Hence, every region has its own honey flow and floral dearth periods of short or long duration and this knowledge on bee flora helps in the effective management of bee colony during such period (Bista and Shivakoti, 2001). In Ethiopia honey flow period is after the heavy rain in July through September known as “Kremt” and most of the Ethiopian highlands are coloured with golden-yellow because of abundance of flower of Bidens species, indigenous oil species like Guizota species and red violent with many different colours (Fichtl and Admasu Addi, 1994 and Tessega Belie, 2009). Reliable nectar producers are: Gallberry, Citrus, Tupelo saw palmetto, Melaleuca, Brazilian pepper and Palm (cabbage) (Delaplane, 2010). Source of both pollen and nectar some of the tree species are Eucalyptus camaldulensis, Optica cylinderica, Euphorboum candelabrum and Olea europeae are. In addition to Leucas abyssinica, Becium grandiflorum, Carissa edulis, Leucaena leucocephala etc. are good source of pollen and nectar. While Zea mays the only pollen and Ocimum basilicum only Nectar sources these and the Major bee plants which are

visited by honey bees throughout their flowering season. E.g. Bidens species (meskel flower), Trifolium species, (Clover), Eucalyptus species, Acacia species, and Vernonia species (Fitchl and Admasu Addi, 1994).

2.6. Honey production constraints in Ethiopia

The existing production constraints in the beekeeping development of Ethiopia are complex and to a large extent vary between agro-ecological zones and production systems (EARO, 2000). Most research reports revealed that the pests and predators, shortage of bee forage, lack of skill and knowledge, low level of technology and honey bee disease, agro-chemical, are the top major constraints in most part of the country (Kerealem Ejigu *et al*., 2009);Workneh Abebe and Puskur,2011; GideyYirga*et al*., 2012).

2.6.6.1. Challenge of Ethiopian Honey Bee Production Development

Despite the high potentiality of the country for beekeeping and its extensive practices, beekeeping research conducted in the nation so far did not coverto characterize and document the apicultural resources and associated constraints of the sector for its proper intervention and utilization to specific potential regions (ChalaKinati*et al.,* 2012).

The major constraint to increasing the welfare of smallholders is their inability to access markets. Enhancing the ability of poor smallholder farmers to reach markets and actively engage in them is one of the most pressing development challenges. Remoteness results in reduced farm-gate prices, returns to labour and capital, and increased input and transaction costs. This, in turn, reduces incentives to participate in economic transactions and results in subsistence rather than marketoriented production systems. Sparsely populated rural areas, and high transport costs are physical barriers to accessing markets; lack of negotiating skills, lack of collective organizations and lack of market information are other impediments to market access (Jones, 1999). Like all living animals, honey bees were infected with disease and attacked by parasites and pests endangering their health and life (Morse, and Nowogrodzki, 1990 and AlGhzawi *et al.,* 2009).

2.6.6.2. Honeybees pestsand predators

Lice are known to infect honey bees in hive. Bee louse are wingless ectoparasite fly which causes significant damage bee colonies. Bee lice larvae feed on honey and pollen by tunneling under the cell capping (Morse and Nowogrodzki, 1990). In Ethiopia infestation of lice in honey bees was reported from the western region of Shoa, Oromia regional state with overall prevalence rate of 42% with highest prevalence rate 70.8% in Gemechis, 50% in Holeta and 17.1% in Jaldu (Gizachew *et al*., 2013). Ants are most worrying to honey bees and bee keeping

sector. Ant eats or carries off any comb contents Ike honey, pollen and brood (Smith, 1953). Ant (*Dorylus fulvus*) was one of important honey bees' enemies and causing a serious problem in West and south western Shoa Zones shows that 44 % of the colonies were attacked by Ants(Desalegn Begna, 2001). Wax moths are serious pests causing damage on wax production in a given colony. The wax moth pests infest stored equipment and weaken colony by spending of time in comb maintenance (Amsalu Bezabeh, Desalegn Begna, 2001). The wax moth in honey bees was reported in the South and South West parts of Ethiopia (AmsaluBezabeh and Desalegn Begna, 2001). In addition to pests various birds and mammals (e.g. humans, honey badgers, baboons, monkeys, mice), associated with or damaging to honeybee colonies, are common throughout Africa (Crane 1999; Hepburn and Radloff 1998; Hussein 2001a, b).The most well-known birds 25associated with honeybees' eater (Meropidae), honey guides (Indicatoridae) and drongos (Dicruridae).

2.6.6.3. Honey guides and Honey badgers

Honey guides are widely known for guiding animals (e.g. baboons and honey badgers) to honeybee nests (Crane 1999). They do not feed on honeybees but consume wax that remains after the nest has been robbed and/or damaged by the guided mammal (Swart *et al*. 2001). Bee-eaters and drongo prey on honeybees and remove the sting/venom prior to ingestion, and severe predation by these birds can cause honeybees to stop foraging (Hepburn and Radloff 1998). Among these birds, Bee eaters are considered to be the most damaging to honeybee colonies since a single bird can devour up to 600 honeybees on a daily basis (Hepburn and Radloff 1998).

Of the mammals, the most destructive are honey badgers and humans. Honey badgers (*Mellivora capensis*) are nocturnal mammals with powerful claws that they use for digging; climbing and breaking hives open (Hepburn and Radloff 1998). Damage caused by humans includes total destruction of colonies (e.g. traditional honey hunting), vandalism, fire, theft and even intentional poisoning of honeybee colonies (Crane 1999; Hussein 2001a, b; Swart et al. 2001; Dietemann *et al.* 2009). The recent decline in honeybee populations and the demand for sustainable pollination to en sure food security have resulted in increased awareness of the need to protect honeybee populations, especially in Africa (Dietemann et al. 2009).

2.6.6.4. Agrochemicals

Honey bees are important pollinators of agricultural crops but very sensitive insects as they are disturbed by the common environmental factor like pollution (Johnson *et al*., 2010). Pesticides are the chemicals that are most widely used to control pests in crop production. When different chemicals are applied to the crops, they are affecting the pests of the crops but also harm the beneficial insects as pollinators, predators and parasites. This harmful effect disturbs the natural

balance between the insects and their natural hosts (Amsalu Bezabeh *etal*., 2012). Worker bees forage outside the hive for pollen and nectar, and thus are vulnerable to contact exposure to pesticides during foraging as well as dietary exposure during collection or ingestion of pollen and nectar. Workers also serve as a vector for bringing contaminants back to the hive. Young workers clean cells and attend brood, whereas middle aged workers do a variety of tasks mainly within the hive.

CHAPTER THREE

3. MATERIALS AND METHODS

3.1. Description of the study area

This study was conducted in Jidda woreda of North Showa zone in Oromia Regional State of Ethiopia. The woreda capital town is Sirt; the town is located at 71 km from North of Addis Ababa and from North Showa zone Fitche 72 km. The District has 13 kebeles of which 12 are rural and 1 urban.The district is boardered in the northern Kembibit in the south Finfine Zuria Special Zone Berrak and Aleltu Woreda, in the East direction Kembibit Woreda ,in the west direction Wuchale woreda and sululta liyu zone (Agricultural and natural source development Office, 2018).

According to 2022 statistics the total population of the Jidda Woreda was estimated to be 75,068 of which 37,618 are males and 37,450 are females. Among these, about 64,900 are living in the rural areas and about 10,168 are urban residents. Of the total population 96.49 % are Orthodox Christians, 1.7% are protestant, 0.199 % are Wakefata and the remaining 1.6 % are Muslim. Crop production and livestock rearing are the main economic activities in the area. Major food crops grown by farmers are largely field crops that include wheat, teff, barely, bean and peas. Livestock production is also an important sub-sector undertaken in line with crop production which play important role in the economy of small holder farmers (Socio Economic Profile of Jidda District, 2019) The average price of honey during the study period (2022) in the study area was 112 and 133 ETB/kg in the time of production season for the crude honey (obtained from traditional hives) and pure honey (obtained from modern hive),

The price of honey is increasing from one production season to another very rapidly due to different reasons: producing pure honey using modern hives, increase in consumer number and inflation of the currency. In general, the mean price of white honey type was found to be higher than the red honey.

The district has a total land area of 48,804.9 hectares. It has 80% highland, 20 % Dega; its agro-ecology is classified as highland “Dega” and largely dominated by mixed crop-livestock farming systems where farmers are based in the production and sales of crops, livestock and livestock products. The district is characterized by flat topography with altitudes ranging from 2,600 – 2,850 meters. The annual average minimum and maximum temperature of Jidda district is 8.5^{o}C and 25.8^{o}C, respectively. The annual average rainfall ranges from 800 – 1100 meters above sea level. (Jidda District Office of Agriculture 2021).

The Topography of the is divided mainly into 22% plains, 11% mountains, 17% Hilly, 37% undulating lands and 13% others.

According to Jidda woreda of Agricultural Office (2021) annual report showed a total of 48,804.9 hectares of land of which 20,280 hectares is used for crop purpose, 25,417 hectares used for grazing lands, 569.9 hectares used for forestry, 2,438 hectares used for others purpose. (The land use system indicates 41 % grasses, 52.3 % grazingland, 1.2% forest and bushy, 5.5 % settlement & waste lands. The Jidda weredas is one of the thirteen Weredas in North Showa zone. Jidda Woreda has thirteen kebeles and one Administration town.

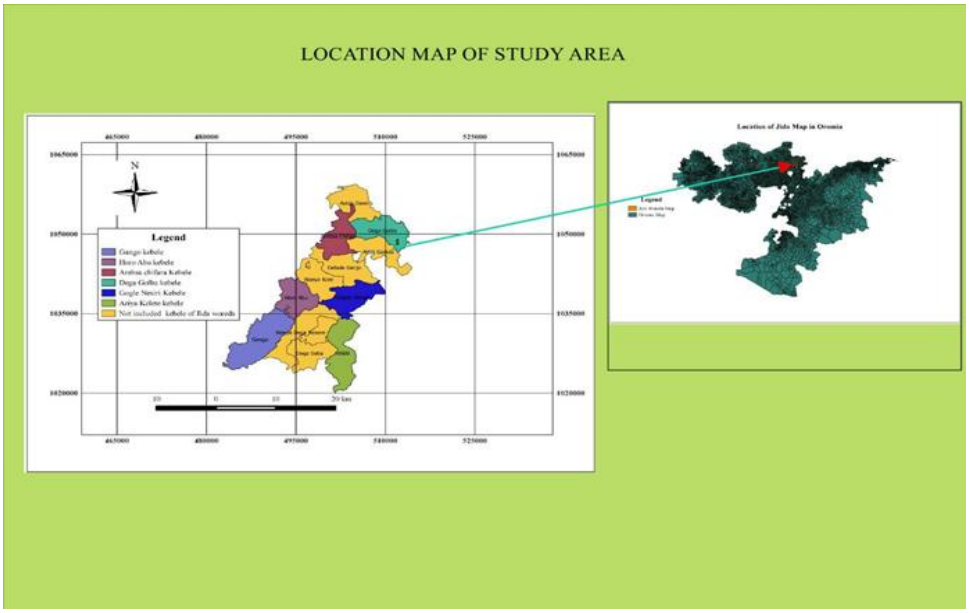

Figure 1:-Map of the study Area (Jidda Woreda) developed by the researcher using Arc GIS.

3.1.1. Livelihood of the people

The main economic activities of the population of Jidda Woreda are agriculture with mixed farming system at subsistence level, producing both crop and livestock. More than 80 percent of the population depends on subsistence farming as the livelihood strategy. The main types of crops cultivated by the farmers in the study area are wheat, teff, barely, bean and peas**.** Livestock is considered as an important component in the farming system of the Woreda. Hence, farmers in the study area possess livestock species such as cattle, equines (horses, donkey and mules), small ruminants, poultry and bee colonies, which serve the households as source of draft power, meat, milk, honey and beeswax, income, manure and means of transportation (Jidda Woreda Administration Office 2019).The main source of income of the study area is obtained from agricultural produce, sale of livestock and livestock products such as milk, cheese and butter, livestock by-products. Besides, non-farm activities such as trade, daily labor,charcoal and fuel

wood selling, pottery production and the like are the main sources of income in the study area. However, income obtained from non-farm activities is limited as compared to farm activities.

3.1.2. Topography, Altitude and climates.

Based on data obtained from WAO (2021) the Jidda Woreda topographic elevation ranges between 800 to 1100 meters above sea level. The climate condition is cold and humid type, it gently slops and the part consists of high plateau, mountain peaks. Interm of agro-ecology 80% of the Woreda is categorized as highland (Dega), 20% as midland (Waina Dega). The majority of ecological division of the Woreda is Dega (Jidda Woreda administration office, 2019). Document of WRLAO (2018) show that the Woreda covers an area of 488.49 square kilometers or 48,804.9 hectares of which 21114.3 hectares are cultivated land, 24602 hectares are grazing land, 2087.99 hectares are settlement land, 383.7 hectares are extension (public organization) land, 40.24 hectares are communal land and 575.7 hectares are forest area. The average land holding is 1.9 hectares per household. The Woreda has two main rainfall seasons: The short rains from April to May and the main rains seasons from June to Mid-October. The average rainfall over the past 14 years is 450 mm per annum with a range of 217.3 to 638.4 mm per year. The mean annual temperature ranges from 16 to 22 degree centigrade.

3.2. Data Sources and Methods of Data Collection

Before conducting field survey research, discussion was conducted with the head of woreda and bee expert to select sites and respondents. Based on the information of district livestock development and health coordinators and bee expert, 105 beekeepers were purposively selected from six PA per woreda to collect the required information. The interview was conducted with the selected respondents to generate the relevant data by using structured questionnaire survey and check list.Visual observation of the apiary management and beekeeping trend was also part of data collection.For this study, the researcher used both qualitative and quantitative data type. In line with this, open and close-ended questionnaire and the interview were used in order to capture relevant information from the targeted respondents. On the other hand, with regard to the data sources, both primary and secondary sources were used.During this survey the study area was classified in to three Agro ecological based on the vegetation and topography. These are highland, midland and lowland. The three agro ecological have different characteristics and also contain representative the other remain area. Therefore based on these agro-ecological the actual survey was applied in the selected site. This study was carried out between Octobers toAugust 2023in North Showa Zone, Jiddaworeda on assessment of honeybee production practices.

3.2.1. Primary Source of data

Primary data was collected from rural household using closed and open-ended questionnaires. Primary data were collected through household interviews and key informants using a semi-structured questionnaire. The questionnaire was designed to generate data on household profiles. Pre-testing of the questionnaire and record sheets was made as a pilot survey, and based on the information obtained at this stage; modifications were made on the questionnaire. The collection of information was made at household level.A pre-tested structured interview and questionnaire was used to obtain socio-demographic information, present and past history in honeybee production and beekeeping practices. The questionnaire was developed in English and then translated in to Afan Oromo to get the relevant information pertinent to the objective of the study.Then the questionnaires were distributed among data collector and respondents were asked to provide information honestly.In addition to the Questionnaires, Interviews, Field observation and Key informant interview were conducted in the attempt to substantiate data collected through questionnaires.

3.2.2. Secondary Source of data

The main sources of secondary data for this study were district agricultural offices, Rural Developmental, previous research findings, literature, journals, internets, report of MoARD at different levels, report of GOs and NGOs at different levels and other published and unpublished materials.

Based on the information obtained from secondary data and informal survey, a structured questionnaire was developed for the household survey with a list of questions covering a wide range of beekeeping activities. The information gathered through household survey includes household characteristics honeybee production practices (number of hives owned, honeybee colonies,types of hives used, place of keeping hives (site), season of honey harvested, honey storage facilities, beekeeping equipment, prevention and control of swarming, potential honeybee plants and flowering time, poisonous plants, dearth period, water resources availability, honeybee pests and predators and otheragrochemical/chemicalsapplications have been collected), farmers' indigenous knowledge on beekeeping, potentials and constraints of apiculture in the study areas.

3.3. Sampling design

From the 13 rural kebels in the Woreda nine were in the agro-ecology of highland/Dega from this kebel the selected were: - Dega Golba, Gogile Nesiri,Gango and Arebsa Cifera and the rest

two kebels from weiynadega, the selectedwere namely Ariya Kelate and Horo Abu,the total six kebeles was selected for this research.

. The selection of the Kebele's was depends on their potential for the Honeybee production activities. From this Kebele's 105farm households were randomly selected. The proportion of house holds with improved and without improved beekeeping in the kebele's 105 sample households mirrors the proportion of households with and without improved beekeeping in the Kebele's. This approach enabled to collect information about improved beekeepers households that are comparable in basic characteristics to the traditional beekeeping serving as counterfactual. From the total of sample households, 19 households had improved beekeeping and about 86household were practice purely traditional beekeeping.

The sampling frame for this study was rural households that are found in two agro-ecological zone of Jidda woreda. In order to minimize the risk of irrelevant conclusionprobability and non-probability sampling techniques were used according to Kothari **(**2004). From probability sampling technique,at the first stage, proportionate stratified random sampling technique was used to select target rural kebeles by stratifying woreda in to agro-ecology as 80% of the Woreda is categorized as highland (Dega), 20% as midland (Weyna Dega). Secondly, six rural kebeles namelyDega Golba, Gogile Nesiri, Gangoand Arebsa ciferawere purposively selected from DegaandHoro Abu and Ariya Kelate were from Weinadegabased on agro-ecological zone respectively. Based on the potential from highland Dega Golba, Gogile Nesiri, Gango and Arebsa andfrommidland Horo Abu and Ariya Kelate were selected with purposive random sampling technique. Single household respondent, was used as sampling unit in this study for the study together with experts and development agents which was based on their accessibility and beekeeping potential. From these PA, a total of 105 households who keep a minimum of 5 and above bee hives were selected randomly.

3.4. Sample

Sampling is the process of selecting some element from the entire population. The target population for the study was rural household who were subject to farmer and pastoral. This study was used 105 sample from the target population of 9,600 rural kebeles including 10% contingency from sample size calculated for non-response and 6 woreda's rural employees from the total population of 10, three up to six farmers /pastoralists were selected from each PA and the total number of sample population was 105(table 1). Data collection methods used for the study include interview by using a semi-structured interview schedule with experts from woreda offices of Agriculture and Rural Development, rural land administration employees, and leaders of rural land administration committee from the total population of 13 each, woreda court president and a

leader of Woreda rural land administration office were used for the study. The total respondents from selected kebele were determined proportionally based on the experience and potentials of beekeeping activities' population size of each kebele's.

Table 1:-Randomly Selected kebele's and total number of respondents

Agro-ecological	Name of kebele's	No.of respondents selected
Midland (weina dega)	Ariya Kelate Horo Abu	34
Highland (Dega)	Dega Golba,Gogile Nesiri, Gango,&arabsa cifera	71
Total		105

3.4.1. Sample size determination formula

Determination of sample size was calculated by using the following formula **(**Kothari, 2004). Then the samples were taken from 2174 of Gega Golba, 1333 of Gogile Nesiri, 1125 of Horo Abu, 2049 of Ariya Kelate, 1696 of Gango and 1223 of Arabsa Cifera. Total numbers of households in the six kebeles are 9600 Household. Where: **n**: is the sample size for a finite population **N**: size of population which is the number of sample kebelesincluding both male and female headed households. p: population reliability (or frequency estimated for a sample of size n), where p is 0.5 which is taken for all population and **p + q**= 1, **e**: margin of error considered is 10% for this study. **Z** α /2: normal reduced variable at 0.05 level of significance **z** is 1.96 According to the above formula, the sample size for the research to be conducted is:

Where: **n**: is the sample size for a finite population

N: size of population which is the number of sample kebelesincluding both

Male and female headed households.

p: population reliability (or frequency estimated for a sample of size n),

p is 0.5 which is taken for all population

p + q= 1, **e**: margin of error considered is 10% for this study

Z α /2: normal reduced variable at 0.05 level of significance **z** is 1.96

$$\mathbf{n} = \frac{\boldsymbol{Z^2 pqN}}{\boldsymbol{e^2\ (N-1)\ + Z^2 pq}}$$

n = $(1.96)^2$ (0.5) (0.5) (9600) =9,219.94n= 95

$(0.1)^2(9600-1) + (1.96)^2(0.5)\ (0.5)$ =96.9504

Compensation per cent of 95 respondents is 10 at 10% margin of error. Then 95+10 = 105

3.5. Data Analysis

Data from the interview and the open-ended question was analyzed in narrative form. Before processing the responses, data preparation was carried out on the completed questionnaires through editing, coding, transcribing (entering), and cleaning the data. Data were edited, coded, classified and tabulated with a view of reducing it to manageable proportions. Data were entered into Excel Microsoft office 2023 and the Statistical Package for Social Sciences survey data that was entered to the computer using (SPSS) version 20 was used for the analysis of quantitative data.

3.6. Ethical Consideration

The ethical consideration was considered in conducting this research to protect the right and authority of participants. The voluntary participation requires that they should not be forced to participate in the research. The researcher will not put them on risk that harm because of their participation.in another way one is guaranteeing the participants in confidentiality.

CHAPTER FOUR

4. RESULTS

4.1. Demographic and Socio-economic Characteristics of respondents

The major socioeconomic characteristics of households interviewed in the Survey are described, these characteristics relate to the relative frequency distribution of Household heads by sex, age, family size, Religion, education level, marital status. It also included household land holding sizes, types of crops grown and livestock composition of Households.

4.1.1. Household characteristics

The total questionnaires distributed were for 105 beekeeper households and 22 guides as key informants were supposed to be interviewed, this 22 means those I used as a key formant and they don't included in the total /105/ beekeeper household, Out of the total questionnaires distributed for Farmer beekeeper, 101 were filled and returned the questionnaire with their response on time. The remaining 4 respondents did not fill and return the questionnaires. Thus, the overall response rate was 96.2%. In addition, the interview was conducted with 21 individuals interviewed successfully on time of schedule and 1 individual was missed.The demographic characteristics of beekeepers were indicated in terms of sex, age, householder, marital status, family size, education level , religious, land size in hectare and agro-ecology of the respondents as showed in the next (Table.2.).

Table 2 .Socio-demographic characteristics of respondents at selected study area. (November 2022, to August, 2023)

No.	Respondents status	Variable categories	Frequency	%
1.1.	Sex/gender of the respondent	Male	82	81.2
		Female	19	18.8
1.2.	Age of respondent	18-25	5	5.0
		26-35	10	9.9
		36-45	55	54.5
		46-55	24	23.8
		56 and above	7	6.9
1.3.	Type of the household	male headed	82	81.2
		Female headed	19	18.8
1.4	Marital status of	Single	5	5.0
		Married	90	89.1

	the respondents	Divorced	3	3.0
		Windowed	3	3.0
1.5	Education level of the Respondent	Illiterate	59	58.4
		1-4grade	21	20.8
		5-8 grade	10	9.9
		9-10 grade	11	10.9
1.6	Religious of the respondents	Orthodox	81	80.2
		Muslim	3	3.0
		Protestant	9	8.9
		Wakefata	8	7.9
1.7	The size of land in hectare of the respondents	>1ha	16	15.8
		1.1-2ha	19	18.8
		3.1-4 ha	24	23.8
		4.1-5 ha	20	19.8
		>5 ha	22	21.8
1.8	Type of air condition/agro-ecology/	high land	67	66.3
		mid-land	34	33.7

Source: - Own computation, August, 2023

4.2. Honeybee Production practices in the study area

In the study area beekeepers have good indigenous knowledge of traditional beekeeping.According to the responses of the sample respondents, the indigenous knowledge used by the interviewed beekeepers were smoking baited hive by swarm attractant materials, honeyharvesting time by smelling, observation at the beehive entrances for what resources thehoneybees are collecting and insert stick to beehive to check for honey presence, controllingreproductive swarming by removing brood, strengthening of colony by feeding with honey aslocal medicine, control of honeybee enemies by different means like cleaning around apiary andusing metals swarm catching, identification of adulterated honey by smelling, tasting and lookingcolor of honey.The result of this agrees with previous findings, (Solomon,2009;Tessega Belies,2009) reported asbeekeepers have deep indigenous knowledge of beekeeping. Beekeeping practice observed during this study was undertaken by three types of bee hives (traditional, intermediate and Movable Frame hives) in the study area,

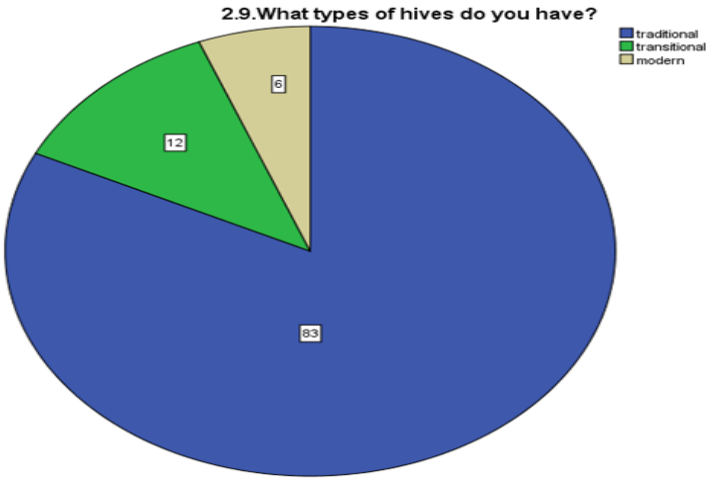

Figure 2:-Types of hive in the stiudy area.

4.2.1. Traditional beehive honeybee production system

Traditional beekeeping is the oldest and the richest practice, which has been carried out by the people for many years ago. The results showed that respondents use the traditional bee hive for honey production activities in the high percentage in the highland area_49.5% whereas in midland 32.7% (Table-3),the researchers understand that the respondent has not enough knowledge of using technological method,. As modern hive, traditional beehive cannot move from place to place to find out forage, water and other sources needed for the bees at different season and this can decrease the quality and quantity of honey. Traditional beehive is the most known in the study area, were used by the sample respondents in the large proportion of the respondents, the beekeepers used locally available material and indigenous knowledge to make traditional hives.. Traditional beehives used are mostly cylindrical in shape with the dimensions of about one meter in length and a diameter of around 20 cm. The shape of the hive is like conical, having large and small openings in the two opposite ends. The size and shape of such hive is not appropriate for rearing brood and as well as honey production. The narrow side limits comb size development.Amboo hive is very common in the area. The outcome of the investigation in-line with other finding conducted sin Central, Northern and South Western part of Ethiopia where traditional beekeeping system is the predominance in the rural areas of the country.In the study area most of the traditional hives are either made locally by the beekeepers or made by local handcraft men and sold in local market..

The internal parts of the hives are plastered with mud and cow dung and the external part iscovered with grass to protect the hive from rain. The other is removable; with entrance holes and it is the opening through which the beekeepers can remove the combs during harvesting. Finally, the hive is fumigated (smoked) for 8-12 minutes with dry cow dung, leaves, barks and split wood of Juniperus or Olea species.

Figure 3:-Traditional honeybee productions in highland in the study area

4.2.2. Transitional honeybee production system

As the conducted study indicated that 6.9% of the respondents in highland and 5.0% in midland of the agro ecologyuse transitional honey bee colony/hive.According to the respondents,(Table 3) transitional beekeeping system has different advantages and disadvantages as well. They explained that the hive is very cheap and easy to construct than frame hives and needs some construction tools and locally available materials.

In addition, individual honey combs can be inspected without destruction when compared to traditional hives. So , when we compare it with frame hives, as a potential disadvantage, respondents have agreed that in this hive, as honey combs are harvested as a whole, honeybee colonies are forced to construct new honey combs again and again which is time and resource consuming. Therefore, this of course has negative impact on productivity of the colonies.This hive can be made from 'Kerkeha' *(Arundinaria alpine),* 'Bargemo' (*Eucalyptus spp),* 'Badessa'*(Syzgium guineense),* 'Shembeko' *(Arundo donax)* and E*ucalyptus* species. This makes it possible for the bee-keeper to observe the combs one by one and to limit swarming by inspecting and removing the production of queen cells.

4.2.3. Modern beehive honeybee production system

As the result indicated that the modern beehive honeybee production system in highland area 4.0% while in midland area 2.0% (Table-3), respectively, when the respondents responds, Movable frame hives allow appropriate colony management and use of a higher level technology, with larger colonies, and canprovide higher yield and quality honey but are likely to require high investment cost and good operational skill,

Concerning the modern hives of the respondents mentioned that the lack of how to operate and awareness about it and they dependence on the use of the traditional hives andalso there is shortage of money to buy modern hive was the main constraint to use modern hive.The main

reasons for low adoption rate of modern bee hives in the study area were lack of finance (lack of credit facilities) to buy input, shortage in supply of beehive accessory equipment, lack of knowledge on how to operate the box hive and inadequate promotion of technology in the studyarea. Thus, there is a need to be facilitated credit service and practical oriented training in improved beekeeping to improve low level of technological input utilization in the study are.

Modern bee hives allow appropriate colony management and use of a higher level technology, with larger colonies, and canprovide higher yield and quality honey but are likely to require high investment cost and good operational skill.

This indicates that the adoption rate of the frame hive is very low. This may be due to late introduction of the technology leading to less exposure of the beekeeping practicing farmers.

Kebede and Lemma (2007)

Table 3:-Type of beehive and honeybee colonies at study area(Novem 2022, to August, 2023)

Types of beehive/colony	Altitude			
	Highland		Midland	
	Frequency	%	Frequency	%
Traditional hive	50	49.5	33	32.7
Transitional hive	7	6.9	5	5.0
Modern hive	4	4.0	2	2.0
Total	61	60.4	40	39.6

Source=from field survey, %=percentAugust.2023

Figure 4:-Frame Honeybee Production System in mid-land

4.2.4. Source of information for usefulness of beekeeping in the study area.

About the important of the modern hive or improved beekeeping 85.1%of the respondent got the information from extension agent/development agents (DAs) of kebeles,4.0% beekeepers got from media, 5.9% from field days and 5.0% from printing material(table 4),respectively.

Table 4:-Information source of honeybee production(November 2022, to August, 2023)

Sourceofhoneybee production	Frequency	%
Extension agent	86	85.1
Radio	4	4.0
Field days	6	5.9
Printing materials	5	5.0
Total	101	100.0

Source= from data survey %=percentAugust**,** 2023

4. 2.5. Sources of Honeybee Colonyand Indigenous Knowledge

The indigenous knowledge on beekeeping differs from beekeepers to beekeepers and also from place to place depending on beekeeping experiences and exposure to beekeeping activities. The main sources of the foundation colony were:-gift from parents, catching swarming bee. When beekeepers were asked to explain how they started beekeeping, about 20.8% answered that they started beekeeping by gift from parent's, andthe majority of them started beekeeping with a colony obtained from swarm catching (73.3%) found in the environment which further indicates that the study area has a potential and is favorable for the bees to liveand 2.0% started beekeeping by buying (table-5) respectively.Similarly asChala*etal***. (**2012) mention that about 87.8% of beekeepers started beekeeping by catching swarm in Gomma district. The result showed that catching swarm was the dominant source in the study area and the Honeybee production system was mostly traditional and this is also most probably because of poor extension services system, poor adoption of improved beekeeping technologies, high costs of beekeeping equipment (but stated above possible to start beekeeping with no cost), lack of government and non-government organization dealing with beekeeping in the study area.

Table 5:-Get colony to start beekeeping practices in study area (Nov.2022, to August, 2023)

colony to start beekeeping practices	Frequency	%
Gift from parent's	21	20.8
Catching swarming bee	74	73.3
Buying	2	2.0
robbing from caves and forests	4	4.0
Total	101	100.0

Source=from data survey %=percent August, 2023

4.2.6 Beekeeping experience

As the result show that the number of the years they have been using honeybee in their lifetime(22.8%)therespondentshave 5 years lastexperiences in beekeeping,(36.6%)respondents have been last 6-10 years of experiences,and**(**40.6%**)** of therespondents have last10-15 years old experiences ranging from 5 to 15years (table 6)respectively. Based on this long years of the experiences of the respondents were helping the new beekeepers to get enough knowledge how to use orholding the technical work 0f honey production system. As the results stated by Gichora(2003),accumulating experience by seeking technical advice from fellow beekeepers and developmental agents.

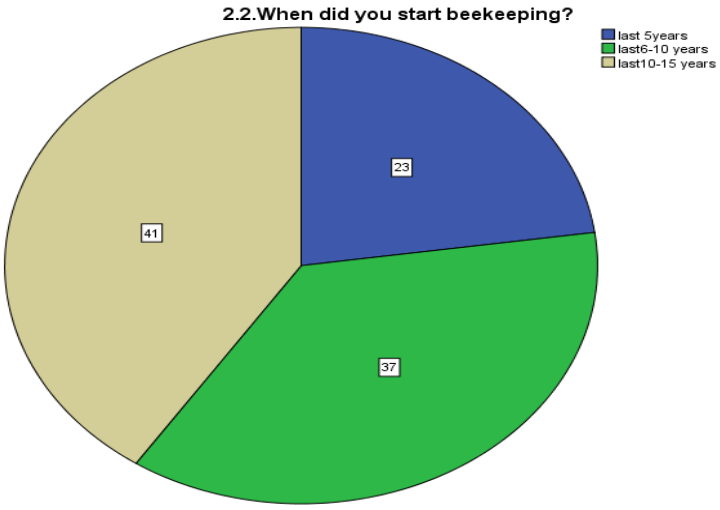

Figure 5:-Honey producing experiences/years/

Source;from Data survey,honey producing experience,August2023

4.2.7. Driving force to have bee colonies

In the study area out of the total respondents about 73.3% of beekeepers used their honey for income, 18.8% forhome consumption and 7.9% both /income and home consumption(table-6-).

This result is similar with the result of Yetmwork Gebremeskel(2015) which shows that about 82.7% of the farmers sell all their produce. The price of honey in the study area as reported by the sample bee keepers is basically depends on color, quality, and source as request appears to remain relatively constant throughout the year. The color of honey in the study area was red yellow and somewhat white. The yellow color honey is most preferred than red. Yellow honey is mostly produced in the low land area. It is lowest during harvesting season of honey (80ETB/kg). Sometimes, the price rises in the months following the soon after harvesting season, of honey (110 ETB/kg). `

Table 6:-Forces to have bee colonies in the study area (%).

Forces to have bee colonies	Frequency	%
Income	74	73.3
Home consumption	19	18.8
Both 1&2	8	7.9
Total	101	100.0

Source=from data survey, August2023

4.3. Placement of Hives /honeybee coloniesat the study area.

Commonly the suitable apiary were to keep bee colony is couldn't near to the road, ,factory area and far from different the community, itis an important consideration for productive beekeeping, thesampled of respondents were placed their beehives in the inside the house (16.8%) and under the roof (26.7%) . it show that simple for observation and to manage the beekeepers in the study area while other respondents (23.8%) and (32.7%)hanging on the trees near homestead and backyard(table 7), respectively.putting the beehives in the house and under the roof of the house it has a serious risk to children and domestic animals, including livestock, in the sense that the bees may swarm out of their hives to sting when they feel disturbed especially during hive inspection, honey full in hives and honey harvesting. The beekeeper indicated that they relocate their children and domestic animals and livestock to neighbor houses to minimize the risk writer Tesfaye Kebede and Tesfaye Lema (2007).Regarding to the beehive placement Deborah and Devid (2008) suggested that groups of 4-8 beehives should be placed at a distance of 152.4 m in order to allow the bees to take advantage of the early morning bloom time. It is also important to place beehives in sunlight preferably with the front of the beehive receiving morning sun to promote early foraging.

Table 7:-Placement of Hives /honeybee colonies in the study area (%).

Variable	Freq,	%
Backyard	33	32.7
Under the roof	27	26.7
Inside the house	17	16.8
Hanging on trees near homestead	24	23.8
Total	101	100.0

Source=from Data survey F= Frequency %=Percent. August, 2023.

The main criteria for apiary site selection of the sample beekeepers were(Table8): access of management (12.9%), avilability of water (8.9%), availability of flora avalibility of flora and fauna (20.8%), close supervision (9.9%),area prevailing (11.9%), free from animal and human (14.9),orentation to sun light (12.9%),

Table 8:-Apiary site selection criteria in study area (%).

No	Criteria to select apiary site	Frequency	%
1	Access of management	13	12.9
2	Avilability of water	9	8.9
3	Avalibility of flora and fauna	21	20.8
4	Close supervision	10	9.9
5	Area prevailing	12	11.9
6	Free from animal and human	15	14.9
7	Orentation to sun light	13	12.9
8	Free from bee enemies and predator's	8	7.9
	Total	101	100.0

Source;-from data survey, %=percent August, 2023

4.4. Hive Inspection and Management

Inspection of hives is one of the mechanisms through which problems faced in honey production are observed and identified. This would help to take necessary corrective or precautionary measures and/or to decide on early harvesting before the problems worsen. There are two types of hive inspection. These are external (without opening up of the hive) and internal (with opening up of the hive). Sample respondents were interviewed to describe the frequency of inspecting their apiary and honeybee colonies and 17.8%, 5.9%, 16.8%, and 59.4%of the respondents replied that they take a look externally into the hives every year, every week, every six month, and not at all except honey harvest respectively (Table 9). Moreover 9.9%, 5.9%, 42.6%, and 41.6% of respondents inspect internally their hive every year, every week, every six month, every month and Not at all except honey harvest respectively. 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 beekeeper farmers is essential. This result agrees with the findings of other researchers(Kerealem, 2005; Tesfaye and Tesfaye, 2007) as they reported that farmers in Ethiopia do not commonly practice internal hive inspection due to the difficulty experienced in inspecting traditional hives internally i.e., fixed combs are attached to the walls of traditional beehives. The only management activities done by some of the respondents were cleaning their apiary for prevention of ants.

T**able 9:-Distribution of frequency external and internal inspection of apiary by Beekeeper (%).**

Frequency of inspection hive	Types of inspection			
	Internal hive inspection		External hive inspection	
	Freq,	%	Frequency	%
Every years	10	9.9	18	17.8
Every weak	6	5.9	6	5.9
Six month	43	42.6	17	16.8
No total honey harvest	42	41.6	60	59.4
Total	101	100.0	101	100.0

Source=from data survey, %= percent August, 2023

During colony inspection, the beekeepers use Smoking hive with local attractant material like *Dry grass,Srtaw,Cow dung, Worn out of cloth,Corn comb, wood of Juniperus and others*are used for frequentinspection as well as during transferring of colonies to other hives cleaning apiary manifested with rain fall distribution,pesticide and herbicide application,lack of water .As

all these materials are not equally available in all agro-ecologies, dried cattle dung was the most dominant smoking material used by all interviewed respondents in the highland and midlands of the study area.

4.5. Trends of Honeybee production in Jidda Woreda

Honey production practices are not new idea in Jidda woreda; it is a farming activity which is practiced as a sideline with other farm activities. Yet in Jidda, there are three types of beekeeping which include: traditional, transitional and modern based on the types of beehives used. The majority of the respondents in Jidda followed traditional production system but only few beekeepers stated transitional (11.9%) and (5.9%) modern beekeeping production system. Shunkute *et al*. (2012) reported that in Kaffa, Sheka and Bench-Maji zones of Ethiopia, traditional beekeeping practice is the dominant system accounting for more than 99% of the total, while intermediate and modern hives are less used (<1%) (Keffa, Sheka and Bench Maji is forest areas where beekeepers practiced more traditional method by hanging). Data showed that beekeeping production system in the study slightly showed improvement.About 43.6% of the respondent reported that beekeeping production decreased with regards to the yields of hives and the number of honeybees populations, this is because of climatic change from time to time as they said flowering plants found in the area previously diminished, and (42.6%) and (13.9%) increased and had stable production system respectively in the area (Table 10). As their responses, the main reasons for decrease in production were: deforestation, un-wise use of pesticides and herbicides, presence of pests and predators in the area, absconding and migrations problem, lack of honeybee's forages, and bee colonies death were mentioned as the utmost problems for the deteriorations of product and productivity of honeybees.

Table 10:-Trend of beekeeping production system (%).

Trend of colony number	Frequency	%
Increase	43	42.6
Decrease	44	43.6
Stable	14	13.9
Total	101	100.0

Source=from survey data, %= percent, August, 2023

4.5.1. Occur of swarming in the study area.

From the total 101_respondents in this study area, about 77.2% reacted occurrences of reproductive swarming in theirapiary with the remaining about 22.8% had no knowhow about

swarming (Table-11). The respondents mentioned that frequency of swarming depends on the availability of honeybees flower andseason of the swarming occurrences._In this survey, it was reported that reproductive swarming has been decreasing from time to time due to various reasons..According to the beekeepers of the study area incidence of swarming occurred when there is enough availability of honey bee forages particularly during the months of October to April. Accordingly, most of (77.2%) of the respondents pointed out that September to November is the time of major swarm formations in the study area this result agrees with report of (Tessega, 2009**)** who recorded 85.80% experience in catching swarm for beekeepers in Burie District of Amhara Region.

Table 11:-Occurance swarming in the stidy area (%).

Variable		Frequency	%
Occuranceof swarming	Yes	78	77.2
	No	23	22.8
	Total	101	100.0
Time of occurance			
Every season		14	13.9
Every years		80	79.2
Once in two years		7	6.9
Total		101	100.0

Source; from data survey, %=percent, August, 2023

4.5.2. The Colony of absconding in the study area.

As the result of the study shows that 98.0% of the respondents experienced the absconding of the honey bee colony and small number (2.0%)of the respondents has a few concept concerning about the causes of absconding were identified in the (Table 12).

Accordingly pest & predatory (51.5%), destroying the nest during honey harvesting (42.6%), shortage of feed and 5.9% poor management are the reasons for absconding as indicated by the respondents. The present study is in agreement with Chalaetal. Who reported similar resason for absconding in Goma district? Similarly Kidane (2014) indicated that about 50% of the beekeepers reported having lost colonies as a result of absconding and migration in Godere district. Absconding refers to the sudden departure of the whole colony from a hive while migration is the seasonal movement of bees from one agro-ecology to another as a coping strategy. Shortage of bee forage causes the honeybee colony to migrate to areas where resources are available for their survival. Shortage of bee forage directly associated with off flowering speriod of major honeybee

plane existence of honey bee pests and predators and off-flowering of honey bee plants ultimately resulted in frequent absconding of colonies and high migratory tendencies. During honey harvesting from traditional hives the beekeepers dismantle the hive, damage the brood, & abandon

Table 12:- Absconding of honeybee colonies in the study area.

Reason and colony absconding		Frequency	%
Occuran of absconding	Yes	99	98.0
	No	2	2.0
	Total(N)	101	100.0
Reason ofabsconding			
Shortage of feed		43	42.6
Pests and predators		52	51.5
Poor bee management		6	5.9
Total		101	100.0

Source=From data survey %=percent N=number of respondents August,2023

4.6. The feeding of honeybee'sandflowering period/season

Honey bee colonies naturally sustain themselves and produce honey by foraging from natural and cultivated crops in all possible radiuses from their nests and store honey for their own consumption during dearth period. In terms of preference by honeybees and abundance, the most important sources of honeybee forage were (Table 13): *Vernonia spps, Negeta azurea ,Pisum sativum, Vicia faba*. Others were *Trifoliumspp,Lathyms sativa, Guizotia scarbe, Bidens prestinaria*and others. Most important honeybee floras of the area flower between August and September. Similar plant species wereidentified as major pollen and nectar sources, for honeybeesin Manasibu districts

Table 13:-The Honeybee forages that reported in the study area from respondents.

No	Species name	Local name/afan oromo	Life form	Flowering period/season
1	*Eucalyptus spp*	Bargamoo	Tree	November–January
2	*Croton macrostachys*	Bakkannisa	Tree	August–October
3	*Vernoniaspps*	Eebicha	Tree	October–December
4	*Ocimum basilicum*	Besobila	Shrub	May–July, Octo–Decemb
5	*rubusspp*	Goraa	Tree	July–November

6	*Mangifera indica*	Mangoo	Tree	May-June
7	*Cicer arietium*	Shumbura	Shrub	May–July
8	*Allium cepa*	Shunkurti	Crop	April ,June, Septr–Nove
9	*Negeta azurea*	Dama-kesssee	Shrub	May-June
10	*Guizotia abyssinica*	Nuugi	Crop	June–July
14	*Cucuerbita pepo*	Dabaaqula/buqee	Shrub	May–July
15	*Pisum sativum*	Atara	Crop	June–July
16	*Vicia faba*	Baqelaa	Crop	June–July
17	*Musa paradisca*	Muuzii		Any time
18	*Trifoliumspp*	Siddisa	Shrub	September–November
19	*Lathyms sativa*	Guwayyaa	Shrub	December–February
20	*Guizotia scarbe*	Tufoo	Shrub	April –June
21	*Carissa edulis*	Hagamsa	Tree	June–July
22	*Bidens prestinaria*	Keelloo	Shrub	September–November
23	*Zea maize*	Boqqolloo	Crop	September–November
24	*Olea aficana*	Ejersa	Tree	Any time

Source= from field survey.August, 2023

4.6.1. Honeybee flora and dry season feeding

Concerning about the shortage of feeding as the respondents respond there is the percentage of shortage feeding (94.1%) in the study area and only small of respondent show the presence of feeding (5.9%,) in the (Table 14) respectively. To reduce the starvation during the period of flower scarcity, some respondent take different methods such ass supplementary feeding like providing,honey (32.7%),bean flour/shiro(18.8%),sugarsyrup (12.9%),water (21.8%) and (13.9%) barley flour/besso/.(Table14), and migratory practices, taking them to areas with good sources of flowering plants, which is also supported by another idea (Assemuetal,2013). During group discussions, all beekeepers responded that they had inspected their colonies for disease and pests. They also practice certain treatments such as fumigation by some type of woody plant, such as olive, which are expected to have medicinal value**.**

Table 14:-Honey bee feeding shortage and types of feed (%) supplemented in the study area.

Honey bee feeding shortage		Frequency	%
Shortage of feeding	Yes	95	94.1
	No	6	5.9
	Total	101	100.0
Types of feed supplemented	Honey	33	32.7
	Bean flour	19	18.8
	Sugar syrup	13	12.9
	Water	22	21.8
	Barley flour,	14	13.9
	Total	101	100.0

Source-from data survey and respondent, % =percent, August, 2022

4.6.2. Source of water for honeybee

As the result show the source of water in the study area contains 12%, spring, 13.9% stream, 52.5% rivers, 8.9% lakes and 11.9% pond (Table -15) as respectively of wells and drinking water. The beekeepers provide water or other solution by putting grass, stone and maize cobs in the container to avoid the sinking or death of bees during drinking. Honeybees require large quantities of water in the beehive to dilute brood feed and to cool the beehive during high temperature

Table 15:-Source of water for honeybee (%) in the study area.

Source of water	Frequency	%
Spring	13	12.9
Streams	14	13.9
Rivers	53	52.5
Lakes	9	8.9
Pond	12	11.9
Total	101	100.0

Source-from data survey and own computation, %=percent, August2023

4.6.3. Beekeeping equipment's and their sources

During the survey, respondents were found to make use of box beehives that were drawn from different sources. It was found that all improved box beehives were prepared in private small and micro enterprise manufacturing centers organized by youth and provided by Agricultural and Rural development Office of the district and different non- governmental organizations on credit basis. At the time of survey, the price of one improved box beehives was Birr 450. When asked to

list the equipment's they use including their prices and duration, the respondents mentioned a wide range of accessories, prices and service periods that goes hand in hand with beekeeping practices. The full ranges of accessories are the following: smokers, gloves, bee, boots, water sprayer, bee brush, knife, honey container, honey presser. It was learnt during the survey that, apart from the known basic hive tools many of the materials are either non-existent or kept by quite few number of respondents.

4.6.4. Honey bee colony holding size

The number of honeybee colony holding size for the production of honey per household by PA in the sampled six kebeles. The entire 101 sample farmer's honeybee colony holding size in thestudy area minimum and maximum ranges from 1 to 7 box beehives and of sample farmhousehold owned 1-3 bee colonies, the majority of sample farmhouse hold owned 4-7 bee colonies during the survey period of thesample households honey bee colony holding size was greater than 7 respectively.

The period of harvesting was also found to be associated with the flowering seasons of various tree, bushes and grass species found in the vegetation cover of the area. However, it is obvious that the flowering season depends on the raining seasons of the area. Similarly, the period of swarming is associated with the flowering stages of different plant species and it occurs just sometimes after the flowering season. In all the study areas two honey harvesting seasons were indicated. Major honey harvesting season was from September to November, October to December. Exceptionally the minor honey harvesting season for Jidda woredawas May to June. Honey harvesting takes place at night and the interviewed beekeepers described that beekeeping by necessity is a group activity. Although beekeeping in the study area is almost exclusively a male occupation, one may occasionally encounter a woman who keep bees or help a family member to harvest honey. At the end of the task the two splits of the hive are assembled together and either kept in the houses for the next season or re-hanged in the trees for the whole year. The honey combs brought home and crushed by hands to get the mixture of honey, beeswax, pollen and sometimes brood. Generally, beekeeping in the woreda is practiced uneconomically in traditional hives of 'tree apiary.

To harvest honey the beekeeper cut away the combs one by one from the back, which is relatively free from bees and pull out the combs by hand. Harvested combs are placed into a container and cover with a lid. By experienced beekeepers, combs that are found bearing brood and unriped honey are left intact for bees to use. Since many of the hives were "beyond the reach of a man's arm" and only one end is worked at a time, some combs would be left intact without being

harvested so that some combs, broods, bees and the queen are not destroyed. Therefore, in this type of hives, the colony survived for the next seasons (FAO, 1996).

4.6.5. Honey market, Honey price and its trend

As beekeepers suggested (47.5%) have prevailing market favorable for their honey. According to respondents result about (23.8%) of sale their honey nearby market place and (10.9%) prevailing market favorability (9.9%) sale their honey at their home and (7.9%) it is not difficult to find market there are so many traders in the locality(table 16).respectively.

According to the information collected from the respondents, the price of honey in the area varies from 400 to 600 Ethiopian birr/kg based on the type of hive from which the honey was harvested. In the same manner, the price of honey fluctuates with highest price in the dry season especially during the period of wedding ceremonies January to April, and also during wet season June to August in the period when there was no honey production and lowest price during honey harvesting time (September to November and May). The general marketing of honey in the Area was promising. They use honey as food, drinks, medicine, and for cultural ceremony

Table 16:-Honey market in (%) study area

Variable	Freq,	%
prevailing market favorability	11	10.9
Prevailing market for their Honey	48	47.5
sale their honey near by market	24	23.8
sale their honey at home	10	9.9
money trends in locality	8	7.9
Total	101	100.0

Source=from data survey,%=percnent,August,2023

In the area the price of honey is subjected to fluctuation with highest price in the off seasons especially during wedding time and also during wet seasons in the period when there was no honey production and they get lowest price during honey harvesting time. Despite this marketing of honey is promising in the area. The respondents revealed that the price of honey in the study area is increasing from year to year due to increasing demand of honey, increasing consumer number and slower growth rate of honey production. The average price of honey during the study period (2022) in the study area was 112 and 133 ETB/kg in the time of production season for the crude honey (obtained from traditional hives) and pure honey (obtained from modern hive), respectively (Table17).

The price of honey is increasing from one production season to another very rapidly due to different reasons: producing pure honey using modern hives, increase in consumer number and

inflation of the currency. In general, the mean price of white honey type was found to be higher than the red honey. This shows that consumers are highly attracted by the color of honey than any other characteristics. Even though the physicochemical properties of honey is important in determining the quality grade, at the moment, traditional quality indicators (color, taste, purity and cleanliness) are used for grading and pricing honey in Jidda.

Table 17:-The average price (Birr/kg) of different honey types over four years in the study area.

Type of honey	Quality	Production year				Mean price (Birr)
		2019	2020	2021	2022	
White	Pure	87	92	112	133	106
	Crude	83	91	102	127	100.75
Yellow	Pure	79	83	96	117	93.75
	Crude	63	70	81	98	78
Red	Pure	63	68	85	93	77.25
	Crude	44	51	58	63	54

Source-Jidda Woreda Agricultural Office, August, 2023

4.6.6. Factors that govern the price of honey

The survey results indicated that the marketing system or the price of honey was affected by different variables .Among manyfactors, the first is quality of honey, followed by color of and taste of honey and season of honeyproduction, respectively. In line with this findingcolor and test of honey and season of honey are found to be the major factors that govern theprice of honey in Gamo Gofa Zones of Southern Ethiopia (Yemane and Taye 2013). Accordingto the survey, the price of honey is in the study area subjected to price fluctuation with thehighest price in the dry seasons, especially during the wedding time from January to April and inwet seasons from June to August, the period when there is no honey production. The lowest price is during honey harvesting season from October to December and June to August. In agreementwith this, beekeepers sell the largest proportion of their honey during harvest season at lowprice mainly to meettheir demand for cash to pay taxes, debts and other social obligation in Jidda woreda.

4.7. Major constraints of honeybee production in the study are

4.7.1. Honeybee pests and predators

According to the respond of beekeepers in the study area_spider (24.8%),ants_ (22.8%),honey badger_(17.8%)_termites(10.9%).bee eating birds_(7.9%), others_(5.0%)and beetles 4(4,0%) respectively, were identified as the major honeybee pests and predators.As the result of this study,

the existence of pests was a major challenge faced by farmers in beekeeping activities,the farmers show that spider, ants, honey badger, termites, and bee eating birds were the most harmful pests in decreasing order of importance (Table 17).

Similar findings were reported by Solomon **(**2009) in the central and south eastern highlands of Ethiopia respectively. Additionally **(**Brad**,**2002) revealed ants, honey badgers, bee eater birds and wax moth devastate honey bee colonies and products especially during periods of dearth in Jidda District. This survey revealed that 20.1% and 18.3% of respondents observed spiderand ants as serious problems that frequently weaken the strength of the colony and resulted in absconding. Some of the respondents (56.8%) indicated placing ash under the hive stands and cleaning the apiary as a good preventive system against ants while the remaining 43.4% could not totally control the ants. The result implies that research should be conducted to find better ways of controlling spiderand ants in honey production.According to the respond of beekeepers, birds, ants, spiders, wax moth, mice, lizards, small hive beetles and honey badger were identified as the major honeybee pests and predators

The beekeepers used different methods to control the birds. Such as keeping their apiary in the morning, remove the constraint place of the bird if it is around home and destroying the nest of birds. To control wax moth from the hive, beekeepers in the study area clean the hive and its environment. Ants, the most important annoying insect has been disturbing the colony which has forced a lot of colonies to abscond and be aggressive.To control the ant the beekeepers in the study area used such methods; - controlling overgrowths grass under hive stand and environment, dusting ash under the hive stand, finding the original house of ant and killing the queen of ant found in the hole, and covering the hive stand with plastic materials. Spiders cover through their webs on the ways of the bees is trapping the honeybees and prey on them. Beekeepers in the study area control spiders only by cleaning the hive mouth/entrance and its environment always in the morning or afternoon. This result is almost similar with the study of Workineh Abebe, (2011): beekeepers protect spiders by cleaning their hive.

Table 18:-Major constraints affecting honeybee's (%) production in your area.

Major constraints affecting honeybee's production	Frequency	%
Ants	23	22.8
honey badger	18	17.8
Spider	25	24.8
Beetles	4	4.0

Lizard	7	6.9
Bee eating birds	8	7.9
Termites	11	10.9
Others	5	5.0
Total	101	100.0

Source=field survey study %=percent August, 2023

4.7.2 .Major constraints of honeybee production in the study area

The major constraints of beekeeping in the study area are presented in the following(table 19) these major constraints of beekeeping as indicated by respondents were pest & predator of honey bees_(29.7%),shortage of bee colony_ (19,8),lack of skill beekeeper (14.9%), highcost ofbeehive(9.9%),shortageofbeeforage(6.9%),chemicalapplication(6.9%),shortageoffacility(3. 0%),diseases(4.0%),swarming(3.0%),and absconding (1.0%).As many researchers discovered that ants and predatory attack is the most serious problem in beekeeping sector (Edessa, 2005; Desalegn Begna, 2007). The result also supported by study of Gidey Yilma et al. (2012) which reported that bee pests, predators and shortage of bee colony are major constraints affecting honey sub-sector in northern Ethiopia. Some of interviewed farmers had used pesticides to control crop and livestock pests and diseases. The majority of beekeepers appeared to be aware of the toxicity of insecticide to bees but none of the beekeepers had taken any measure to protect their bees from the sprayed chemicals. According to the beekeepers of Jidda district, the critical constraints and problems affecting honeybee production include inadequate production technologies, limited availability of bee flora mainly due to deforestation, lack of beekeeping knowledge/skill,And marketing accessibility.

Table 19:-Major constraints of beekeeping in (%) the study area.

Constraints	Responses	
Agro-ecological challenges	Frequency	%
pest and predators	30	29.7
shortage of bee colony	20	19.8
lack of skill beekeeper	15	14.9
high cost of bee hive	10	9.9
shortage of bee forage	8	7.9
chemical application	7	6.9
shortage of facility	3	3.0
Diseases	4	4.0
Swarming	3	3.0
Absconding	1	1.0
Total	101	100.0

Source: from Field survey study, %=percent August, 2023

4.7.3. Major opportunities of honey bee production

Even though different constraints have been described for their possible effects exerted onthe beekeeping subsector, it has been an established fact that the country is endowed withdifferent opportunities and immense potentials. Accordingly, some of the opportunitiesassociated with the study area and described by the respondent beekeepers were availability of feeds, waters, diversity of forage and honey bee, and seasonal availability of bee forage, as well as the presence of traditional know-how about honey bee production by the farmers.

CHAPTER FIVE

5. CONCLUSION AND RECOMMENDATIONS

5.1. Conclusions

Even if the study area hasa huge potential for honeybee production beekeeping practice are very limited in the study area, Therefore, the availability of traditional honeybee production system is still the most known in two agro-ecologies. In_high land agro-ecology of study area, traditional, transitional and modern honeybee production_systems are practiced in the different way where in the mid land agro-ecologies, traditional, transitional andmodern honeybee production system were more performed.Beekeepers have different knowledges depend on type of honeybee production system.On traditional honeybee production systems beekeepers develop skill from family and communities,less educated beekeepers rely on practice_more on traditional honeybee productionsystem, where literate beekeepers used more with transitional and frame/modern honeybee production system. There is mixing placement of traditional, transitional and frame hives and back yard apiary site is the major one in the study area.There was no honey marketing channel at woreda and village level. Beekeepers sell their honey to local market and costumers. The prices of honey always decided by buyers_depending on the time of honey harvesting season and color of honey. Honey production in the study area has been faced with many constraints, the effect of agro chemicals application oncrops, pest and predators, absconding, shortage of bee forage, shortage ofwater, absence of market center, but study area has a lot of opportunities availability of bee flora, honeybee resource and attention. Hence farmers in the mid land and high land should practice traditional hive and transitional hive honeybee production system.

5.2. Recommendations

Since both honey yield and honeybee production systems with traditional,transitional and modern hive more in mid land and high land, these two agro-ecologies can be considered as potential for honey productionin the study area the government and non-government should contributed the male and female beekeepers proportionally in different beekeeping trainings.The effect of agrochemicals application on honeybees and means of minimization their effect should be addressed,it is first important to evaluate the time of application in such a way that it doesnot have an effect on the honeybees.The government and non-government should organize the market center for beekeepers and training on management of honeybee.

Large scale and comprehensive research on constraints and honeybee diseases are highly recommended to set appropriate solution.

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APPENDICES

APPENDIX: A

ADDIS ABABA UNIVERSITY

POST GRADUATE PROGRAME

COLLEGE OF NATURAL AND COMPUTATIONAL SCIENCE DEPARTMENT OF ZOOLOGICAL SCIENCE

Questionnaires for Honeybee production practices

Dear Participants,

This questionnaire is prepared by Tiruneh Wadajo Feyissa, Msc student in Addis Ababa University, Department Zoological Science for partial fulfillment of master degree. The aim of this questionnaire is to collect data about the assessment of honeybee for honey production practices in north showa Jidda woreda, Oromia region, Ethiopia. The information you provide is believed to have great value for the success of this research. I confirm you that all data will be used for academic purpose and will be analyzed anonymously and you are not exposed to any harm because of the information you give. I highly appreciate in advance to your kind cooperation in providing the necessary information.

General instruction:

The researcher uses this questionnaire for the genuine information is highly decisive to the success of this study, therefore:-

No need of writing your name

Put encircle for your answer in a given choice

With great excuse!

For any question or suggestion contact the researcher through the following addresses:-

Phone no 0921203221/0910623219

Email-tirunehwadajo@gmail.com

1. Please encircle a choice that is appropriately represents your response in the multiple choice questions.

2. To the open-ended questions, please write your response on the space provided.

1.2 Region ---------- 1.3. Zone --------- 1.4.Woreda ---------- 1.5. PA /Kebele ----------

1. Demographic factors of Beekeeper

1.1. Sex/gender of the respondent 1,male 2,female

1.2. Age of respondent 1,18-25 2,26-35 3,36-45 4,46-55 5,56 and above

1.3. Type of the household 1,male headed 2, female headed

1.4. Marital status 1,single 2, married 3,divorced 4, windowed

1.5. Education level of the respondent 1,Illiterate 2,1-4grade 3,5-8 grade 4,9-10 grade

1.6 .Religion 1.Orthodox 2, Muslim 3Protestant 4= Wakefata

1.7. The size of your land in hectare? 1=1<ha 2=1.1-2ha 3=3.1-4 ha 4=) 4.1-5 ha 5) >5 ha

1.8. What type of agro-ecological do live in this area? 1=highland 2=midland

2. Beekeeping situation

2.1 Do have your own honey bee hive? 1.yes _____ 2.no_____

2.1.1 If you answer yes how many_____

2.2 When did you start beekeeping?

2.2.1.last 5years

2.2.2.last6-10 years

2.2.3.last10-15 years

2.3.What are the driving forces to have bee colonies

2.3.1. Income

2.3 2.Home consumption

2.3.3. Both 1&2

2.3.4. Others

2.4 .How do you get colony to start beekeeping practices? Source of bees

2.4. 1. Gift from parent's

2.4 2..Catching swarming bee

2.4.3. Buying

2.4.4. robbing from caves and forests

2.5. Where do you keep your bee colonies or hive?

2.5 1.Backyard

2.5.2.Under the roof

2..5.3. Inside the house

2.5.4. Hanging on trees near home

2.6. Did your colonies abscond? 1. Yes_____ 2. no_____

2.6.1, explain the reason_____

2.7. What types of hives do you have?

2.7.1. traditional¬¬¬¬_____,

2.7,2. transition_____

2.7.3.modern _____

2.8. Do you think that there is shortage of bee forage in your local area? 1. Yes 2. No

2.8.1. If your answer is yes, what you take for the solution?_____

2.8.1.1.Honey_____

2.8.1.2.Water _____

2.8.1.3.Barley flour_____,

2,9,Frequency of inspection

2.9.1. External hive inspection:

2.9.2. Internal hive inspection:

3.Vegetation, honey plants and water availability

3.1, Is there honey bee Feed shortage? 1,yes_____ 2,no_____

3.2. Do you give additional feeds to your bees? 1.yes_____ 2.no_____

3.2.1. What type of flowering plants do you have?_____

3.4 Does water available for your honeybees at all the time? 1. Yes _____ 2. No_____-

3.5, What source of water do you have?

3.5.1.Spring_____

3.5.2.Streams_____

3.5.3.Rivers __

3.5.4.Lakes_____

3.5.5.Pond_____

3.6. What is the Honey market, Honey price and its trend in these areas? ----------

4,Agro chemical/chemical ,constraintats and inspection

4, 1.In what stage of the crop growth you apply the chemicals?_____

4, 2.Describe the utilizations of your beehive products_____.

4, 3.When do you use agrochemicals/chemicals (months)?

5.major constraints of honey bee production

5.1., What are the major signs observed on honey bees related to these chemicals?_____

5.2. Are you aware of agrochemical effects on honey bees? 1.Yes_____ 2.No _____

5.3. Who are the major constraints affecting honeybee production in your area?

5.3.1.ants

5.3.2.honey badger

5.3.3.spider

5.3.4.beetles

5,3.5,lizard

5.3.6.bee eating birds

5.3.7.termites

5.3.8.others

6,Swarming

6.1. Does swarming occur in your colonies or locality? 1= Yes_____ 2=No_____

6.1.1. If your response is yes, what is the frequency?

6.1.1.1 Every season_____yes--------no----------

6.1.1.2.Every year _____ yes--------no----------

6.1.1.3.Once in two years_____ yes--------no----------

6.1.1.4.Others, specify: _____

7. Beekeeping equipments and protective materials

7.1. What are the smoking materials you are using?

7.1,1.Dry grass,

7.1.2. straw,

7,1.3.cow dung

Yuniveersitii Addiis Abbaabaattii (finfinee)

Gaaffiifi Deebii/ Interviews & Question in Afan Oromo

Qorannoo Barnoota Ebbifamtoota muummee saayinsii Uumamaa Dipartimaanti Zoologikaal Saayinsii

Aagarsiistuu/Mul'istuu waliigalaa

Gaaffilee Qotee bultootaan guutamaan

Maqaa qorraatichaa =Xurunaa Wadaajoo Fayyissaa

Sababaaleen Gaaffaannoo Kanaa haala horsiisaa Kannisaaf damaa bifa akkami akka horsiisaamuu,gosa gaguurraa fi wantoota kannisaa damaa midhaan Hubannoo argachuun mirkanneffachuu dha.

Deebii sirrii fi amanamaa ta'ee qorannoo kanaaf haalan ykn daran barbachisaadha waan ta'eef yaada sirrii fi dhugaa ta'e gama keessaaniin akka naaf laatan jechaa Gargarsaa fi tumsa guddaa ykn gaarii waan naaf gootaniif akkasumas yaadooleen dhuunfaa gaaffileen koo fi gumaachiftan (laataaniif) duraan dureese galataa guddaa isinif galchuun barbaadaa.

Yaada fi gaaffiii daballataa qoraaticharraa argachuu yoo barbadaan=

Lakk.bilbilaa-0921203221/0910623219

Imaali- tirunehwadajo@gmail.com

Ajajawwan waliigalaa /general instruction/

Qabxiileen Gaaffaannoo kooti haala armaan gadi kanatti fuufanii kan jiraani dha.Isaaniis eeyyee ykn mitii kan jedhuu irraatti marii/deebii kenni/

Gandaa/goxii/ _____

1 ,Laalleewwaan (Information) Waliigalaa Qotee bulaa

1.1 Saala 1=dhiiraa 2=dubaartii

1,2,umrii, 1=18-25 2=26-35 3=36-45 4=46-55 5=56 ol

1.3,hogaana mana 1,haadha mana 2, abbaa mana

1.4 haala gaa'eelaa 1,qophaa 2, fudha/heerumt 3,hikee 4, boqote

1.5 haala barnootaa 1,hin baranee 2,kutaa1-4 3,kutaa5-8 4,kutaa 9-10

1.6,amaantaa 1.oortoodooksii 2, Muusilimaa 3.pirootestaantii 4, Wakeffata

1.7 qabiyyee lafaa hektaraan, 1=1<ha 2=1.1-2ha 3=3.1-4 ha 4=) 4.1-5 ha 5) >5 ha

1.8 haala qilleensaa naannoo 1.badaa 2, badaa daree

2. Haala eegumsaa kanniisaa

2.1 gaaguraa maataa keetti qabdaa? 1,eeyyee 2,mitii

2, 1, 1, yoo qabatee meqaa?_____

2.2. Yoomi eegaltee?

2.2.1, waggaa 5n duraa

2,2,2, waggaa 6-10 diraa

2,2,3.waggaa 10-15 duraa

2.3, Sababaa maalif kannisaa horsisuu eegalte?

2,3,1.galiif

2,3.2. haala jireenyaaf

2.3.3. lamanuuf

2.3.4. kan biroof

2.4, gaagurraa kanaa eenyurraa argatee?

2,4,1, kennaa maatii

2,4,2.mootii kaannisaa qabudhaan

2,4,3,bitaadhaan

2,4,4,bosonaarraa

2.5. Gaagurraa kee eessaattii eegdaa?

2.5.1.manaa keessattii

2.5,2.mana jalaatti

2,5.3.mana gidduu

2,5.4,mukarraatt rarraassuu

2.6. Kanniinsii godaanuu ni danda'aa? 1,eeyyee 2,mitti

2,6,1.sabaabootaa isaa tarreessi_____

2.7. Gosaa gaagurraa isaa kam qabdaa?

2.7.1. aadaa ¬¬¬¬_____,

2.7,2. Cee'umsaa _____

2.7.3. ammayyaa _____

2.8. Naannoo ati jirraattuu kana hanqinnii nyaata kaannissa ni jirra/ 1,eeyyee 2, mitt

2, 8, 1, yoo jirraattee rakkoo kanaa maaliin furtaa?_____

2.8.1.1. dammaa _____

2.8.1.2.bishaan _____

2.8.1.3. dakkuu qamaadii _____,

3.kuddurraalee,mukkeen dammaafi gaahumsaa bishaan

3.1, nyaatni gahaan jiraa? 1,eeyyee 2,mitii

3.2.nyaata dabaalatt ni lataaf ?1,eeyye 2, miti

3.2.1. gosoota darraarraa naannoo kee jiraan tarreessi_____

3.4. Bishaan gahaa qabdaa? 1,eeyyee 2, miti

3.5. Maddii bishaanni kee maalirraattii?

3.5.1. bishaan bola _____

3.5.2. burqaa _____

3.5.3. bishaan cisaa __

3.5.4. bishaan yaa'uu _____

3.5.5.Pond_____

3.6. haali gabaa damaa akkam?mi;a moo gadii bu;aadhaa?----------

4,haala keemikaalaa,wantoota midhaa fidaaniifi too'annoo

4,1.sadaarkaa kamitti keemikaalaa fayyaadamtaa?_____

4,2.fayyidaalee gaagurraa kaannisaa maalfa'i_____

4,3.waktilee kamitti keemikaalaa fayyadamtaa/ji'a/?_____

5.wantoota jajjaboonni horsiisaa kaannissaarraatti dhibbaa fidaan

5.1., midhaa keemikaalaa jijjarramaa kaannissaarraat fidaan?_____

5..2.midhaa keemikaalaa irraatt hubannoo qabda?1,eeyyee 2, miti

5.3.wantoota jajjaboo midhaa fidaan keessaa muraasni

5.3.1. mixxii/ gundaan /ants

5.3.2. dhaaddee / honey badger

5.3.3. shaarraaritt /spider

5.3.4.qorrophisaa/beetles

5,3.5, Lootuu/lizard

5.3.6.bee eating birds

5.3.7.termites

5.3.8.kan biroo/others

6,Godaansaa

6.1. Godaansi kaannisaa naannoo kee jiraa? 1,eeyyee 2, mitii

6.1.1. deebiin kee eeyyee yoota'ee

6.1.1.1 waqtii hundaa 1.eeyyee 2, miti

6.1.1.2.waggaa gutuu 1,eeyyee 2, mitt

6.1.1.3.wagaa lamaati si'a tokko 1,eeyyee 2,miti

6.1.1.4.kan biroo,ibsii_____

7. Meeshaalee eegumsaaf ittiisuuf garagaarraan/Beekeeping equipments and protective materials

7.1.Waantoota ittii aarsuuf atii fayyaadamtuu maal fa'i?

7.1,1.margaa gogaa/ Dry grass,

7.1.2 straw,

7,1.3.dhokee horii/cow dung