THE MAIN PRACTICES, CHALLENGES AND OPPORTUNITIES OF HONEY PRODUCTION AND MARKETING AT WORKAWOTU, NORTH WOLLO, ETHIOPIA

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Abstract: *This study assessed honey production and marketing in Workawotu of Gidan district, North Wollo, Ethiopia in 2018/2019. Data from 47 household beekeepers out of 90 who engaged in apiculture were analyzed using SPSS version 20. The results showed that most beekeepers placed their colonies in the backyard (72.3%) or eaves of the house (27.7%) and harvested honey twice a year in September-November and May-April. Swarming was the main reproduction mechanism that increased the colony number and occurred mostly in September-November (72%). Three types of production systems were identified: traditional, transitional and modern. The traditional production system was the most common, but had low productivity due to drought, predators and poor management. The main predators were Bee eater birds and honey badgers. Agro-chemicals and diseases were not major problems. The transitional and modern production systems had higher productivity, but were less distributed. They also provided supplementary feeds like besso and shiro during the dearth periods from December to February and March to May. The marketing chain was weak due to low infrastructure and quality. The study also provided important recommendations to improve honey production and marketing in the study area.*

Key words: Honeybee, Teji, Beekeeping, Apiculture, Gidan, *Workawotu*

1. Introduction

1.1. Background of the Study

Ethiopia has a longstanding beekeeping practice and endowed with huge apicultural resources. It has been an integral part of other agricultural activity and provides sustainable livelihoods to many small scale farmers and other rural and non-rural people (FAO, 2012). More than 5.15 million hived honeybee populations are found in the country (Adgaba, AAL, *et al*., 2014). Owing to its varied ecological and climatic conditions, Ethiopia is home to some of the most diverse flora and fauna in Africa. Its forests and woodlands contain diverse plant species that provide surplus nectar and pollen to foraging bees. Beekeeping has been practiced since ancient times and honey has been

considered by many cultures as a valuable and precious commodity that is used in traditional rituals, healing or as food (Lietaer, 2009).

Beekeeping is one of the oldest farming practices in Ethiopia and has a long tradition that stretches back into the millennia of the country's early history (Deffar G, 1998; Hartmann I, 2004). Ethiopia is a leading country in Africa and ninth in the world in honey production. Similarly, it stands first in Africa and third in the world in beeswax production (CSA, 2012). However, the productivity per bee colony and the product quality are low, leading to high domestic utilization and low export earnings. Hence, the beekeepers and the country are not benefiting from the sub sector. On the other hand, there is high global demand for natural products like honey and beeswax with huge difference between supply and demand. Moreover, farming system approach to research and development is recognized as the most appropriate method to describe, diagnose and gain knowledge of the technologies and factors affecting production and marketing at farm levels (Amir P, Knipscheer HC, 1989). This study was conducted in (Workawotu) of Gidan district, North Wollo, Amhara regional state, Ethiopia to realize the main practices, challenges and opportunities of honey production and marketing. Honey production in Gidan district is the basic source of cash income for subsistence farmers; it has been used as supplementary food and environmental conservation means. There is little compiled and reliable information on honey production and beekeeping practices, production potentials and constraints of honey production and beekeeping. Numbers of beekeepers, number of honeybee colonies, amount of honey produced, type of beekeeping practiced and way of handling honeybee products are not well known in practices more especially in Workawotu.

2. Objective

The mail objective of the study is to understand the current situation and potential of honey production and marketing in Gidan district, North Wollo, by identifying the main practices used by beekeepers, the major challenges they face, and the opportunities they have to improve their livelihoods and contribute to the development of the sub-sector.

3. Methods and materials

3.1. Description of study area

This study was conducted in Workawotu Workawotu of Gidan district, North Wollo, Amhara regional state, Ethiopia. Workawotu (Workawotu) is located between Wefchat in the north, Dengelsa in the East, Rikach in the West and Densa in the south.

The area of Workawotu is 2960.5 hectare. The topography of Workawotu is characterized by 35% plane land, 25% numerous escarpments (steep slope), 30% low land and 10% other forms land formation (Gidan Agricultural office document, unpublished). Workawotu is found in dega agro-ecology.

The society in the Workawotu is characterized by food deficit due to rugged topography that results in low agricultural performance, degradation and drought. The people in this livelihood zone use mixed farming; and shoats, sheep, honey and cattle sale are the main sources of cash income though market access is poor due to poor market network (ALZR, 2005).

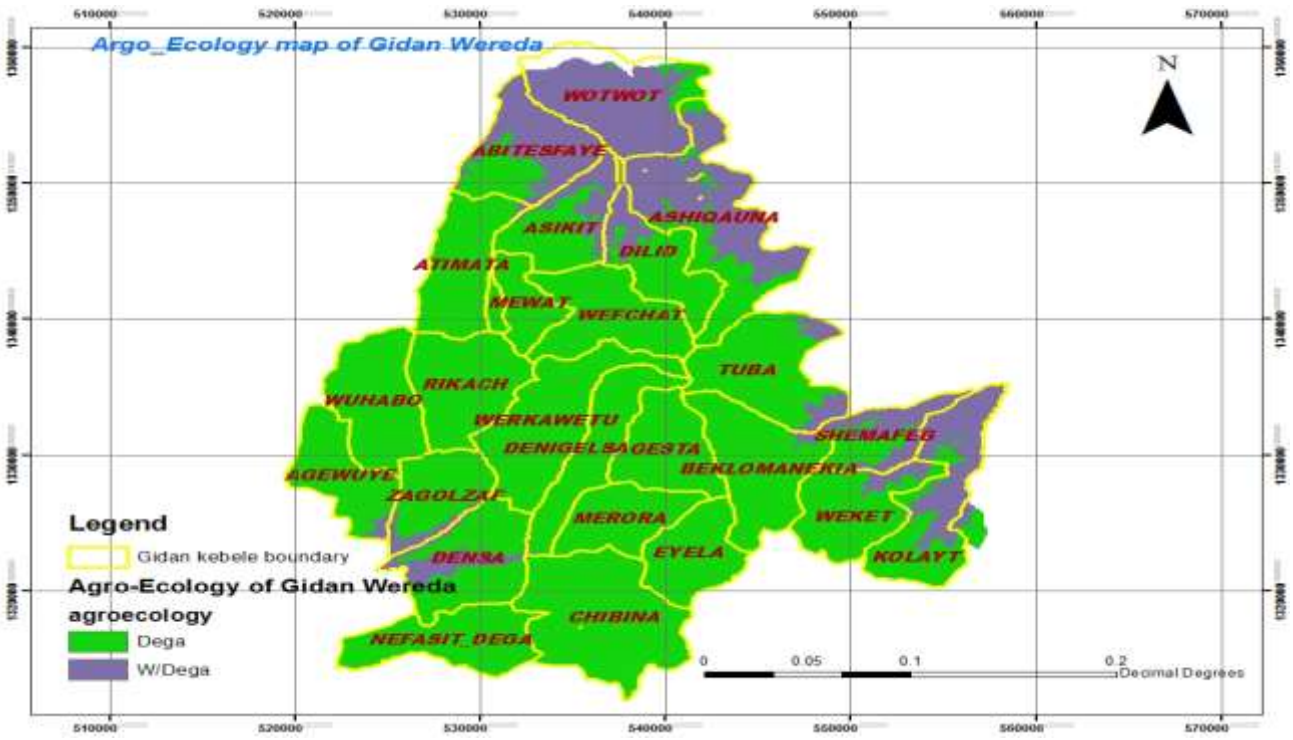

Figure 1: Gidan district

3.2. Demography of Workawotu

The Workawotu has 7877 total population. From this, 3780 are men and 4096 are women. The majority (99.61%) of the inhabitants practiced Ethiopian Orthodox Christianity. From the populations that inhabit in the study area 90 households are honey bee keepers. From this number of beekeepers 50 beekeepers have practiced traditional system; twenty beekeepers have followed both traditional and modern practice; and ten beekeepers have practiced both traditional and transitional form of practices (Gidan Agricultural office document, unpublished).

3.3. Sampling methods and data collection

3.3.1. Sampling

This study used random sampling technique to select 47 sample households from 90 households that engage in apiculture in the study area. The total households included in this study were determined according to the formula given by Yamane (1967) with 90% confidence level. A single household respondent was used as sampling unit, and the list of farmers participated in beekeeping activity within study area was used as sampling frame. The sample households were selected from three types of production systems: traditional, transitional and modern. Five both traditional and transitional household beekeepers from the total 10; ten both traditional and modern household beekeepers from the total 20; and thirty two traditional beekeepers were randomly selected from the total of sixty. The selected households' beekeepers were interviewed by using structured interview questionnaire to address opinion variations of households in the study area.

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

3.3.2. Data collection

Data were collected from 47 randomly selected beekeepers using structured interview questionnaire in Amharic language. The questionnaire collected both quantitative and qualitative data, which were translated to English by the researcher. The researcher also observed and photographed the production technique, hive placement, types of hives and marketing systems.

3.3.3. Statistical data management and analysis

Descriptive statistics (such as mean, frequency, and percentage) were used to summarize household characteristics, honey production and marketing practices, challenges and opportunities.

The collected data were entered and analyzed using Statistical Packages for Social Sciences (SPSS) version 20.

4. Results and Discussion

This section provides an overview of the beekeeping practices of sample respondents in Workawotu based on observation and the questionnaire survey result. In this section, the results are presented and discussed more specifically and entirely to the situation of sample households.

4.1. General characteristics of the respondents

4.1.1. Gender of the respondent

The majority of the respondents (93.6%) were male, indicating that males were the main society responsible for controlling and managing honeybee production in the study area. Only few women participated in the beekeeping practice due to factors such as: night-time activities, aggressive behavior of bees, fear of bee stings and lack of experience. Women sometimes assisted in hive making, plastering and storage, processing and marketing of hive products. This is consistent with the work of Gebretsadik *et al*., (2016) and Abebe *et al*. (2015) that reported low participation of women in honey production.

4.1.2. Marital status and religion of the respondents

Most of the respondents (85%) and (100%) in the study area were married and orthodox religion followers, respectively. In agreement with this, Abebe *et al.* (2015) reported majority of the respondents (88.3%) were married.

Table 1: Sex, marital status and religion of the respondents in the study area (N=47).

Category	**Variables**	**N=47**	
		F	**%**
Sex	Male	44	93.6
	Female	3	6.4
Marital status	Married	40	85.1
	Single	6	12.8
	Divorced	1	2.1

4.1.3. Age of the respondents

The mean age of the respondents is 40 years that range from 27 to 69. The mean age indicates that most of the honeybee keepers are at the productive age.

Table 2: Age of the respondent in the study area (N=47)

N	Minimum	Maximum	Mean	Standard division
Age of the respondent	27	69	40.13	12.787

4.1.4. Educational background of the respondents

Some of the respondents were below basic education (31.9%) and some had learned from grade 5-8 (23.4%). The remaining some (19.1%) had engaged in basic education (adult education, "Golmasa') and primary school first cycle (Grade 1-4) (17%). A few (8.5%) had learned from grade 9-12. The higher number of respondents in the study area would be as a means of opportunity to handle beekeeping activity at household level. As it is indicated, most of the beekeepers have attended primary and secondary school respectively; whereas, about 31.9% respondents are below basic education or who cannot read and write. It is quite understood that educated farmers have better understanding to accept new ideas that improve the existing production system.

Table 3: Educational Status of the Head of the Household (N=47)

Educational Status	Frequency	%
Below basic education	15	31.9
Basic education	9	19.1
Grade 1-4	8	17
Grade 5-8	11	23.4
Grade 9-12	4	8.5

4.2. Honey Production System in the Study Area

The three types of production system existed in the study area. As agricultural officers of the Workawotu responded most of the beekeepers have followed traditional system of honey production. Some has practiced modern production; and a few has practiced transitional form of production, i.e. they ranked, traditional, modern and transitional form of production 1st, 2nd, and 3rd, respectively.

4.2.1. Traditional honey production system

As all of the agricultural officers responded traditional ways of honey production system is highly diversified forms in the study area. There are 90 household beekeepers that completely followed

traditional alone ways of honey production system in the study Workawotu. In consistent to this finding, majority (60%) of the respondents practice beekeeping activity using traditional hive whereas about 15% and 25% used transitional and modern bee hives, respectively, (Seyoum *et al*., 2018). The predominance use of traditional hive in the study area is in line with other findings conducted in different parts of Ethiopia. For instance, Abera *et al*. (2016), in the study of beekeeping in Damot Gale district, southern Ethiopia indicated that most of the respondents (70%) in the study area practiced traditional beekeeping whereas only about 22 and 8 percent practiced transitional and modern bee keeping system, respectively. In common sense, the traditional beekeeping system utilizes accessible, cheap and plentiful local materials for hive construction and related issues very easily. These hives are also constructed using the indigenous knowledge among the beekeepers. The sample respondents have greater number of traditional hives because they have easily constructed from locally available materials like cow dugs, mud and Ash. As most of the respondents responded, honey yield and colony number in traditional system decreased (48.9%) due to drought, and predators (66.7%); and poor management (26.7%). Some respondents (38.3%) also responded that honey yield and colony number increased due to extra-feeding of the colony (94.4%) and good market price (5.6%). Traditional hives are cost effective and convenient to construct, as the five agricultural experts responded, since it is less dependent on external input/accessories. The colonies in traditional system face more swarming frequency than others.

Figure 2: Traditional production system and placement in the backyard

4.2.2. Transitional honey production system

As agricultural officers responded there are 10 household beekeepers that have followed transitional forms with traditional forms of production system in the study area. According to the respondents, 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. Furthermore, individual honey or brood combs can be inspected without destruction when compared to traditional hives. In addition to that, 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.

Colony number and honey yield in transitional system has always increased due to mostly the use of new advancement as compared to traditional system (60%) and availability of additional foods for the colony. But, the distribution is so limited in the study area. As you can see in the beekeepers can construct from the locally available materials by themselves.

Figure 3: Transitional hive

4.2.3. Modern honey production system

There are 20 beekeepers (22.2%) that have followed modern beekeeping system with traditional forms of production system in the study area. Colony number and honey yield in modern types has always increased due to mostly the use of new technology (70%); and sometimes the availing of extra feed (20%); and good market price (10%). Based on the study, the only problem for constructing top-bar hive by beekeepers were inabilities and absence of the input materials since it

cannot be constructed by local materials as traditional and transitional honey production system as you can see in. Due to this problem the hive distribution was very low.

As the five agricultural experts responded, modern system with movable frame hive is suitable to harvest, give more qualitative honey, more durable with regard to service, and more important to get more colonies through colony split.

4.2.4. Sources of honeybee colonies

Most of the respondents (55.3%) in Workawotu have obtained the honey bee colonies through buying from other beekeepers that had the colonies before them. Some of the respondents (23.4%) obtained their colonies as gift from their parents. Similarly, in Ada Berga district the respondent beekeepers have started beekeeping with a colony given from parents as a gift, catching swarms, and bought from other beekeepers (Mekonen, 2016). This result also agrees with the result of Haftu Kebede and Gezu Tadesse (2015) reported that most respondents 60.3% replied that they have got their colonies by catching swarms and the rest from their parents and buying.

Sixty percent of transitional beekeepers obtained their transitional colony of hives from catching swarms. The remaining some of them obtain from buying and transferring bee colonies from traditional to transitional hive. Most of modern hive bee keepers obtained their honey bee colony from catching swarms (70%); buying (10%); and gift from parents (10%).

4.2.5. Placement of honey bee colony

Most of the beekeepers (72.3%) in the study area have placed their honey bee colonies in the backyards which agree with the report of Mekonen (2016) that claimed most of the beekeepers kept their hives at back yard. This may be simple for management and day to day service for beekeepers in the study area. This also in line with Tessega (2009) reported majority of the sample respondents (48.7%, 34.2% and 1.7% with traditional, modern and transitional hive respectively) keep their colonies around their homestead (back yard) mainly to enable close supervision of colonies. Some (27.7%) have placed under the eaves of their house. Almost all forms of transitional and modern hives placed in backyard. Similarly, Tessega (2009) in *Burie* district reported some of the sample respondents (47.1%, 5% and 0.8% with traditional, modern and transitional hive respectively), keep their colonies under the eaves of the house. Furthermore, none of the interviewed beekeepers kept their colonies in the forest, inside the house, and hanging on

trees near home stead. In addition, all the respondent beekeepers have no separate apiary for traditional, transitional and frame hives they keep in the same place they have.

4.2.6. Honey and colony production trends

Honey yield and colony number in traditional honey production system mostly decreased due to predators, little drought, poor management. This agrees with the report of Tessega (2009) in Bure district honeybee products production was in a decreasing trend due to shortage of bee forages, drought, pesticides and herbicide application, lack of water and poor management in order of importance. But in contrast, honey yield and colony numbers in transitional and modern forms of production system has always increased in the study area due to use of new technology (advancement in material use) and provision of extra feeds since the beekeepers expected more products.

4.2.7. Sources of hives

Most of the traditional hives (61.7%) were constructed by the bee keeper themselves. Some house hold beekeepers (38.3%) occasionally bought from the market. All transitional hives were constructed by the beekeepers themselves. Most of the movable frame hive provided by the government with fee (80%), but some hives availed by the government without fee (20%).

4.2.8. Main advantages of hive in production system

As the five agricultural experts responded, modern system with movable frame hive is suitable to harvest, give more qualitative honey, more durable with regard to service, and more important to get more colonies through colony split. Traditional hives are cost effective and convenient to construct since it is less dependent on external input/accessories. The quality honey in traditional and transitional honey production system is very low in the study area. In concur to this report Abebe *et al.* (2015) reported honey collected from traditional and transitional hives is Behavioral characteristics of honey bee in the study area

Based on their indigenous knowledge, beekeepers have their own methods of categorizing their honeybees, mostly based on the color, size and behavioral features of the honeybees. Sample respondents were asked to describe local name of their honeybee colonies. They described *Wanzie* which is docile in behavior, grey in color and small in size; and *Shanko little aggressive in behavior*, black in color, medium in size. Sample respondents were also asked to describe

preference of their honeybee colonies and majority of them replied that they highly prefer *shanko* that is highly docile (70%), black (63.8%) and medium sized (68.1%). Therefore, majority of the respondents characterized *Shanko* as more productive; tolerant to starvation and other problem; and is hard worker than other types of honeybees with large body size. The degree of preference to *Wanzie* by beekeepers might be due to their assumption that this variety has gentle or moderate behavior.

4.2.9. The effect of diseases and Agrochemicals

Honeybee diseases cause significant effect on the health status and wellbeing of the honeybees. Even if they couldn't identify the common name of the disease all agricultural experts responded the existence of diseases. But, all (100%) of the beekeepers responded diseases were not the problem of honey bee production and productivity in the study area which is in contrast to findings of most research in our country Ethiopia like Birhanu (2016) and Seyoum and Anja (2018) who reported diseases were one of the problem.

None of the farmers use agro-chemicals either for pests or herbs in the study Workawotu since they need the herbs (weeds) for their cattle feed; and the distribution of harmful pests that damage farm crops in the study area is very low because the agro ecology of the Workawotu is dega which is less suitable to such pests. Agro-chemicals and pests are not the common problem in the study Workawotu. This report is in argument to most of the research finding in Ethiopia like Birhanu (2016) and Seyoum and Anja (2018) who reported indiscriminate use of agrochemicals were the common problem.

4.2.10. The effects of predators in the study area

Honeybees are exposed to a broad range of various environmental challenges, which can be an impact to apiculture. Most beekeepers distinguished the problem of their bee colonies. As most of the respondents (46.8%) responded birds and honey badgers (Shelemetmat) are the most common problems in the study area. This result agrees with the result of Firisa Woyessa and Dejene Alemu (2016) reported that 51.7% honey bee abscond by the reason of birds. Beekeepers in the study area used different methods to control those pests and predators. Building strong fence and kill with the help of doges, to control honey badger. The bee eater birds as a predator of the honeybees and difficult to control have been identified as a serious problem (challenge) for beekeeping in

the area. This bee eating bird is sitting on a nearby branch of a tree or a fence and catches the worker bees at the hive entrance. The beekeepers used different methods to control the birds. Such as keeping their apiary in the morning, remove the constant place of the bird if it is around home and destroying the nest of birds.

4.2.11. The availability of Honey bee flora in the study area

As a matter of fact, the country at large and the study area in particular have been described as rich in floral resources. The diverse agro-ecologies and topography has been identified as one of the most important beekeeping potentials in North Wollo because of its floral resources. The availability of multipurpose trees and shrubs in the study area has been identified not only as major sources of pollen and nectar for honeybees but also provide different services to the community. Of course, the interdependency between honeybees and floral resources also enables the reproduction, productivity and diversification of plants on earth. As the respondents said there are many different honey bee floras in the study area. Some of the plants that were mentioned by the respondents and Agricultural experts were various cultivated oil crops like lean seed (Telba); pulse like lentils, beans, peas; and field flowers like “Adey Abeba”, “Tosign”, , and ”Mentesie”. Others like Teff, wheat, barley, maize and different horticultural crops were some of the most common crops grown by the farmers and so many other herbs which are very important to bee forages and honey production.

4.2.12. The effects of poisonous plants

They have mentioned some poisonous plants that they expect to harm the quality of honey even though honey bees are selective for plants to forage nectar and pollen. As some of the respondents (48.8%) said there are some types of poisonous plants in the study area like “Endod”, ‘Simiza”, “Eret”, “Qulqual”, “Chiret”, and “Azo hareg”.

4.3. Shortage of bee forage

Shortage of bee forage leads a devastating problem that retards the production and productivity of honeybee colonies especially during the drought period.

4.3.1. Extra feeds of honey bee in the study area

Most of the beekeepers (85.1%) in the study area fed their colony in December to February (40%) and March to May (60%). Most of the beekeepers managed their bees with extra feeding (70%)

since supplementary feed is required for the honeybees; and provided “Besso” and “Shiro” alternatively when the season is dearth. This agrees with the report of Tessega (2009) in Bure district that 58.3% of the respondents were providing supplementary feed; include “Beso”, and “Shiro”. This also agrees the report of Abebe *et al.* (2015) more than half of the sample respondents used to provide supplementary feeds and water to their colonies in modern and transitional hives in dearth periods.

4.2.2. The access of water in Workawotu

The availability of water (95.7%) was not the problem for honey bee production and productivity. Rivers (65.25%) and spring (34.8%) water were the main source of water in the study area.

4.2.3. Honey bee reproduction, migration/Absconding and Honey Production season

Colony absconding or migration (68.1%) is not that much common in the study area. Colony migration was not that much common, but it sometimes occurred from March to May (40%). This result disagrees with the result of Firisa Woyessa and Dejene Alemu (2016) reported that absconding was the most common problem mostly in traditional hives.

Honey is harvested at the end of flowering time. In the study area there are two phase of honey harvesting period. Most of the respondents (76.6%) harvested their honey in a year from September to November and May to April. The major and the most known to all beekeepers is September to December and the minor one is from April to June. Hence, the period of honey harvesting clearly shows that the supply follows the flowering pattern of the flora which results in peak supply of honey during specific period and dropping during the dry season during which the bee colonies require extra feed. Which was similar with the result of Tessega Belie (2009) in *Burie* district and Chala Kinati *et al.* (2013) in Goma district, time of peak honey harvesting is from the last days of September to December.

4.2.4. Honeybee colony swarming

It is obvious that swarming is a means of reproduction in honeybee. As most of the respondents (82.2%) said swarming is the main events in the study area that occurred mainly from September to November (72%). Similar to this, about 95%, and 54.7 % of the respondents reacted occurrences of reproductive swarming in their apiary in Gadeo zone (Gebretsadik *et al*., 2016), and in Bure district (Tessega, 2009), respectively. All (100%) of the

beekeepers have got different advantageous of swarming. Some of the main advantageous are increase the number of colony (25.6%); to sale the colonies and get income (10.3%); and to replace non-reproductive bee colonies (12.8%). But, most of the respondents (51.3%) use the swarm colony for all the above mentioned reasons. All the respondent bee keepers had controlled and prevent colony swarming through removal of queen cells (25.6%); return the swarm colony back to the new colony hive (48.7%); removal of queen cells and harvest or cut honey comb (25.6%). Similar to this Tessega (2009) reported the most frequently ways of controlling reproductive swarming by the respondent beekeeper in *Burie* district were removal of queen cell (46.2%), killing queen of the swarm and reuniting of honeybee colony to its mother (28.2%), use large volume of hive (1.7%) as colony increase and kill new emerged queen (0.9%) Almost all bee keepers in the study area have experience how to catch the colony swarm using swarm attractant materials (100%) like "Tela difdif", smoked empty hive and spraying water for swarm catching.

4.2.5. Harvesting honey bee product

According to most of the respondents (76.6%), they harvested their honey twice a year from September to November and May to April in the study area. The study area is a dega (high land) agro ecology that has favorable weather conditions; abundant plant diversity; adequate rainfall distribution; sufficient water access and so on. In agreement with this, Kalayu *et al*. (2017) reported that the frequency of honey harvest was higher in the highland area than the other two agro-ecologies due to the availability of various bee forage; honeybee colonies; water availability due to adequate rainfall distribution that lasted for four to five months; suitable weather conditions for bees etc. Most of (91.5%) beekeepers only collected honey and few (8.5%) beekeepers collected crude bees wax. Most beekeepers did not collect bees wax because of lack of knowledge; lack of processing materials; and lack of market. All of Bee keeper respondents did not take out all honey combs during harvesting time. They left an average of 3 honey combs in the hive for honey bees to feed on them.

4.3. Honey management

4.3.1. Honey straining, and storage and transport containers

Some beekeepers (31.9%) strained their honey with a clean cloth (73.3%) or a sieve (26.7%), but most (68.1%) did not because they lacked knowledge (29.1%) or materials (71.9%) to do so, or because consumers preferred unstrained honey (6.3%) in the study area. Beekeepers stored and sold their honey in various containers, mostly plastic ones (78.7%), which affected the quality of honey. About 99.4% of beekeepers in Ada Berga district used traditional containers that were not suitable for honey storage (Mekonen, 2016). Most beekeepers stored their honey for seven to twelve months (70.2%), some for one to six months (27%), and few for one to two years. They did so to maximize profit (88%), use honey for medicinal purposes, save money, or consume honey continuously. Abebe *et al*. (2015) and Birhanu (2016) reported similar findings on honey storage practices and motives. Some beekeepers also believed that storing honey increased its weight and value. All of the beekeepers in Workawotu kebele were profitable from beekeeping, which provided them with extra income without much investment. Most beekeepers (93.6%) in the study area had good indigenous knowledge of traditional beekeeping.

4.3.2. Inspection of honeybee colonies

Most beekeepers (68.1%) did not strain their honey due to lack of knowledge, materials, or consumer in the study area. They stored and sold their honey in various containers, mainly plastic ones (78.7%), which lowered the quality of honey. Almost all beekeepers in Ada Berga district (99.4%) used unsuitable traditional containers (Mekonen, 2016). They stored their honey for one month to two years for different reasons, such as profit, medicine, saving, or consumption. Abebe *et al*. (2015) and Birhanu (2016) confirmed these findings. Some beekeepers thought that storing honey made it heavier and more valuable. All beekeepers in Workawotu kebele profited from beekeeping, which gave them extra income with little investment. Most beekeepers (93.6%) in the study area had good traditional beekeeping knowledge.

4.3.3. Beekeeping extension service and training

Besides indigenous knowledge, most beekeepers (66%) had joined beekeeping extension programs to adopt modern beekeeping methods. About 61.7% of beekeepers received beekeeping training once every six months (72.4%) or once a year (27.6%). Tessega (2009) reported similar results on

the participation and frequency of beekeeping training among respondents in Burie District. They all also wanted more beekeeping training because the previous training had long intervals that did not fill the knowledge gap on modern beekeeping in the study area. Tessega (2009) also found that 96.7% of the trained respondents needed additional training to learn how to use improved hives and equipment, manage honeybee colonies, grow suitable bee forage plants, process higher quality products, and market them.

4.4. Marketing system in the study area

The study of honey marketing channel aims to provide systematic knowledge of how honey is traded from its origin to the final destination. Honey production is mainly for table food, but the supply of honey is limited due to poor quality production practices despite the high potential in the study area. A survey on the bee products market in Workawotu kebele showed that honey was the major product, compared to beeswax (absent in the local market) and honey bee colony. This is consistent with Abebe *et al*. (2015), who reported that most (95%) of the respondents produced honey primarily for market. The honey marketed in the district was crude honey harvested mostly from traditional hives mixed with unripe and brood honey/comb. There was a structure to connect beekeepers and traders of honey, but it was not used consistently. There was also a lack of appropriate marketing infrastructure in the study area and the district, which hindered the development of this sector. Some of the major constraints in the marketing system were: lack of appropriate hive products' marketing place; lack of market information; absence or lack of known market route or channel; buyer dependent price settings; lack or inappropriate functioning of marketing cooperatives; less awareness on post-harvest handling of their produce, etc.

4.4.1. The main factors that govern marketing process

The farmers in the study area produced and sold honey for their daily income. The main honey colors produced and marketed were white and red. All beekeepers sold their honey in the study area, mostly from February to April (51.1%), followed by October to January (25.5%), October to April (17%), and May to July (6.4%). Most of the respondents said that the color and taste of the honey (quality) (63.8%) determined the price of the honey. This result is consistent with Mekonen (2016) in Ada Berga district, who reported that the price of honey depended on color and quality. Some of the respondents also used other factors, such as all colors and tastes of honey; seasons of the year; traditional ceremonies; and market force (supply and demand) (40.4%) to set the price of

the honey in their locality and market place. The main customers of honey in the study area were consumers (48.9%), retailers (21.3%), wholesalers (19.1%), and Teji houses (10.6%). Most beekeepers sold their honey at the nearby market place (61.8%) and some at the main market place (38.4%). According to the respondents, the demand, supply and market price were balanced. That is, the demand was high (57.4%); the supply of honey was enough (57.4%); and the local market price was medium (57.4%). They also sold some of their honey bee colony from September to November (61.7%), December to February (21.3%), and March to May (17%).

4.4.2. The price of honey and honey bee colonies

One household beekeeper produced an average of 45.6 kg of honey in two seasons of a year. This result was higher than the result of Atsbaha *et al*. (2015) in Tigray region, who reported an average of 28.29kg of honey per year. This may be due to the difference in management; extra feed availability, more uncultivated land, and more important bee forage flora in Gidan District, such as "Mentesies", "Tusign" and legumes plants and other shrubs. The average price of one kilogram of honey in the study area was 220 EBR. One household beekeeper could earn 10,018 EBR from honey sale in a year. White and red honey was the dominant types in the study area, with average prices of 211.9 and 153 EBR, respectively. They also sold honey bee colony occasionally for 3241 EBR. The average price of honey bee colony in traditional, transitional, and modern hive was 844, 938 and 1814 EBR, respectively. The beekeepers rarely bought traditional and transitional hives in the study area because they mostly made them by themselves. The average price of traditional and transitional hive was 60 and 102 EBR, respectively. This is similar to the finding of Kalayu *et al* (2017) in North-East Dry Land Areas of Amhara National Regional State, where some beekeepers bought transitional hives for 100 -120 ETB. However, modern beekeepers always bought movable frame hives from the market or got them from the government with a fee. They paid an average of 835 ETB per hive. This is slightly lower than the price of modern hives reported by Kalayu *et al* (2017) in North-East Dry Land Areas of Amhara National Regional State, where they were bought for 1000 -1500 ETB.

5. Conclusions

The study found that traditional honey production system was the most common practice in the study area, but its production trends have decreased due to various challenges. Honey bee colonies were obtained through buying, gift from parents, or catching swarms, and were mainly placed in

the backyard or under the eaves of houses. The common varieties of honeybees were "Wanzie" and "Shanko", with beekeepers preferring Shanko due to its productivity, tolerance to starvation, and hardworking nature. Predators and poor management were the main problems faced by beekeepers, while agro-chemicals and diseases were not common. The area had diverse flora to provide nectar and pollen, and extra feed was provided during non-flowering periods. Honey was harvested twice a year, but beekeepers did not strain their honey and stored it in local materials. Beekeepers inspected their hives externally and sometimes internally, but beekeeping extension services and training were infrequent. Marketing of honey was limited due to inadequate infrastructure, lack of knowledge on post-harvest handling, and unknown marketing routes.

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