Practices and Challenges of Beekeeping in Chiro District of West Hararghe Zone, Eastern Oromia, Ethiopia

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Abstracts: Ethiopia is the leading honey producer in Africa and one of the ten largest honey producing countries in the world. However, low productivity and poor quality of honey and other bee products are the major constraints faced by honey producers. The exact number of people engaged in honey production and the challenges they face are not well known. Lack of documented information on honey production and challenges hinders extension supports. Therefore, a survey was conducted in Chiro district (woreda) in 2013/2014 with the objective of eliciting information on practices of honey production, beekeeping management systems and associated challenges faced by honey producing farmers in the study area. Six representative peasant associations were selected using a purposive sampling method. A total of 120 beekeepers were interviewed on major beekeeping management practice and challenges they were facing. The results were subjected to descriptive statistics using SPSS. Of all the respondents, only 8 (6.7%) were women. A total of 863, 818 traditional beehives and 45 modern beehives were owned by the respondents. The average numbers of traditional and modern beehives owned per respondent were 6.87 and 0.38 respectively. Only 58.8% of the traditional beehives and 46.7% of the modern beehives were colonized by bees while the remaining ones were empty. Most (53.4%) of the respondents kept the beehives under the roof of their houses where as 30.7% kept them in the garden; 15.1% inside the house, and the 0.8% on trees. The main sources of the foundation colony were three, i.e., catching bee swarms, gift from family, and buying. The major challenges were shortage of bee colonies, escalating prices of modern hives and their accessories as well as low level of extension services. It is concluded that honey production in the study area is dominated by traditional practices, and constrained by shortage of bee colonies, inadequate farmers' technical know-how and practical skills, high prices of modern hives and their accessories, lack of practically supported extension services on modern beekeeping technologies, incidences of pests, low participation of women, and lack of year-round availability bee forage. The results imply that the sector needs tangible supports from the extension system in terms of improved technologies as well as in building knowledge of farmers for better management of honey bees to increase productivity and income of households through honey production.

Keywords: Absconding; Bee colony; Beehives; Beekeeping; Respondents; Swarming

1. Introduction

Of all the countries in the world, no country has a longer tradition of beekeeping than Ethiopia (Ayalew and Gezahegn 1991). It seems as old as the history of the country and it is an integral part of the life style of the community (Adebabay *et al.,* 2008). The exact number of people engaged in the honey sub-sector in Ethiopia is not well known. However, it is estimated that there exist more than 10 million bee colonies and more than one million farm households involved in beekeeping business using the traditional, intermediate and frame beehives (Gidey and Mekonen, 2010).

Ethiopia is the leading honey producing country in Africa and one of the ten largest honey producing countries in the world (Ayalew, 1990). The country is also one of the four largest beeswax producing countries (MoARD, 2012). However, low productivity and poor quality of bee products are the major economic impediments for rural beekeepers (Nuru, 1999). Honey bees play also a great role in pollinating plants and farmers are realizing that vegetation is a source of forage for bees. As a result, they are conscious enough to protect vegetation from destruction and propagate more plants to provide pollen and nectar for honey bees. In the process, many plants are conserved and protected from destruction (FAO, 2009). Holetta Bee Research and Training Center is the only institution in the country that formally undertakes adaptive and applied research on apiculture (HBRC, 2003). However, research conducted in the country so far regarding beekeeping has not elucidated the practices and challenges of beekeeping in large areas of the country that have high potential for honey production. Similarly, no studies have so far been conducted to identify management practices, constrains, economic benefits, and potential of honey production in most areas of the country. In Chiro district (woreda) and the highland areas of West Hararghe Zone, which is covered by high forest (Jallo Forest), and is characterized by both arable land and shrubby hills. To improve beehive management practices, researchers and experts have been giving a series of training to honey producing farmers in collaboration with Haramaya University and

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Non-Governmental Organizations. The feedback obtained from farmers has indicated existence of different challenges in the sector. However, no any systematic study has so far been carried out on honey production and associated challenges in the district. This study was, therefore, conducted to elucidate beekeeping practices and challenges as well as the degree of participation of women in production of honey bee and its products.

2. Materials and Methods

2.1 Description of the Study Area

Chiro is one the districts (woreda) in West Hararghe Zone. The site is bordered on the South by Kuni town, on the West by Guba Koricha district on the Northwest by Mieso district, on the North by Doba district on the Northeast by Tulo district and on the East by the Galetti River which separates it from Mesela and East Hararghe Zone. The site is located about 325 km to the East of Addis Ababa along the main road to Harar and Dire Dawa. It has a latitude and longitude of 9°05'N 40°52'E and an altitude of 1826 meters above sea level.

Agro-ecologically, the district is classified as highland (10%), mid-land (36%) and low land (54%) with altitude of 2300 - 3200, 1500 -2300 and 500-1500 meter above sea level), respectively. The district has a bimodal rainfall distribution pattern, which is most frequently erratic and its average annual rainfall is between 600 mm to700 mm. The mean annual temperature varies between 17.5°C and 27.5°C (MoA, 1998).

2.2 Sampling Techniques, Data Collection and Analysis

The survey was conducted in six Peasants Associations (PA) of Chiro district in West Hararghe Zone of Ethiopia from September 2013 to June 2014 (Fig. 1). Both purposive and random sampling was used in this study. Purposive sampling was used for selection of the six PAs based on their accessibility and beekeeping potential. From each PA, 20 beekeeping farmers (a total of 120) were randomly selected from among all beekeepers and interviewed by using a pre-tested semi-structured questionnaire. The core points of the questionnaires for primary data collection on identifications of beekeeping management practices included: number of bee colonies owned, type of hives used, amount of honey harvested per colony, apiary management, bee colony placements, absconding and swarming rate, honey flow seasons and pest and predator management practices. For identification and prioritization of challenges faced by farmers in beekeeping activities, the sampled beekeepers were interviewed on natural and man-made beekeeping variables; beekeeping knowledge and related extension services, availability of bee colonies, bee predators, and availability of beekeeping equipment, drought and market. To identify women participation in beekeeping practices, women ownership of beehives and the level and type of beehive management were considered as the major variables. The number of women owning beehives from among the randomly selected 120 beekeepers was used to calculate the level of participation in beehive ownership. All sampled men respondents were interviewed on the willingness of involving women in hive managements. Secondary data were also additionally collected from the district's Agricultural and Rural Development Office. The data were analyzed using SPSS software and descriptive statistics.

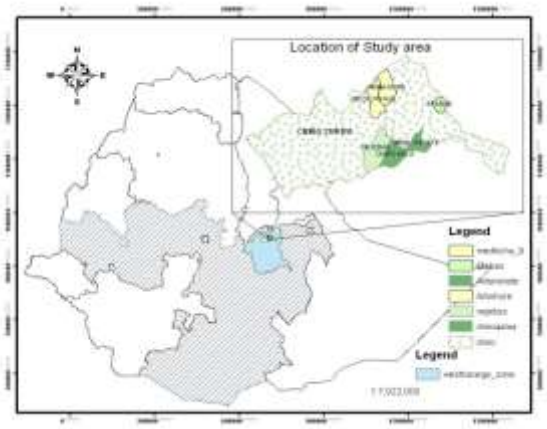

Figure 1. Map of the study area

3. Results and Discussion

3.1 Household Information

The age group of sampled beekeepers ranged from 15 to 82 years old. Accordingly, 86.1% of the respondents were between 30 to 60 years of age, while age groups of 15 to 30 and above 60 years were 8.9% and 5.1% respectively. The result showed that people in the most productive age are actively engaged in beekeeping activities with an average experience of 6.34 years. The survey result indicated that 14.2, 19.3 and 66.4 % of the respondents had above 20, between 10 and 20, and less 10 years of experiences, respectively in beekeeping. Concerning the educational background of the respondents, only 4% of the beekeepers had education level of up to 12 grade whilst 32% had education level of 8th grade. About 44% of the beekeepers had only basic education (read and write) whereas 39% were illiterate (Table 1).

The result also indicated that 84.8% of the respondents are young beekeepers, whose age ranges between 15 to 45 years, which has the advantages to exert positive effort to integrate natural resource conservation with modern bee keeping technologies (Table 1). .

Table 1. Household information.

Parameters used for beekeepers	Variables	Frequency (N)	Respondents (%)
Educational level	Illiterate	39	32.8
	Basic education	44	36.9
	Grade1-4	18	15.1
	Grade5-8	14	11.8
	Grade9-12	4	3.4
Age group of the	15-30	11	9.2
	30-45	90	75.6
	45-60	12	10.1
	>60	6	5
Experience, years	< 5 years	41	34.5
	5-10	38	31.9
	10-20	23	19.3
	20-30	14	11.7
	>30	3	2.5
Total		119	100

3.2. Type of Hive Owned and Colony Distribution

Fig. 2 depicts beehive ownership and bee colony distribution. A total of 863, 818, and 45 traditional and modern beehives, respectively, were owned by the 119 respondents. The average traditional and modern beehives owned per respondent was 6.87 and 0.38, respectively. 58.8% of the traditional hives and 46.7% of the modern hives were colonized bees while the remaining ones were empty. A total of 502 bee colonies with an average of 4.22 colonies per head were owned by the farmer respondents. The number of bee colonies owned in traditional hives ranged from 1 to 50 with an average of 4.04. Only 15.2% of the respondents had modern hives with and without bee colonies and none of the respondents had transitional hives. The relatively lower numbers of modern hives owned that traditional hives owned could be attributed to the respondents' inadequate level of awareness and know-how on its operation (39.7%), high costs of modern hives (40.5%), and unavailability of modern hives in the area (19.8%). Out of 863 hives owned by all respondents, only 45 were modern hives of which only 21 (46.7%) were colonized by bees. Accordingly, the average functional modern hives owned per respondent was 0.18. According to the respondents, about 53.3% empty modern hives lay idle for more than two years. This could be attributed to the fact that all of the modern hives were given to the farmers free of charge by different NGOs without provision of any training on how to do bee keeping and with no accessories required to operate the hives.

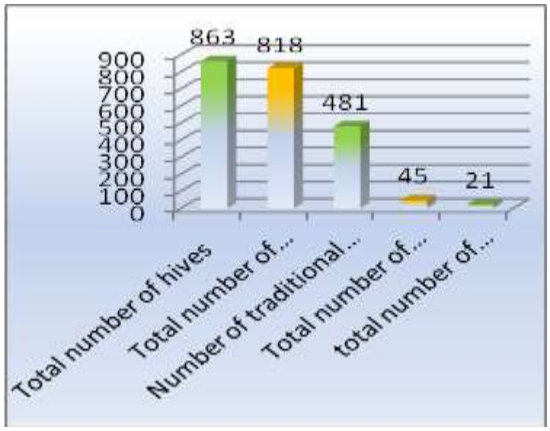

Figure 2. Types and number of hives with and without bees in Chiro district of Western Hararghe Zone of Ethiopia

3.3 Participation of Women in Beekeeping Activities

As shown in Table 2, out of 119 respondents, only 8 (6.7%) were women. The result showed that all of the 8 women were widowed and acquired the hives from their husband after death. According to the response of the male beekeepers, there were a few cases whereby they accompanied their wives and/or daughters during hive management activities. Most of the beehives management activities were male dominated (Table 2). Female participation was nil in activities like preparation of hives, installing hives, inspecting and harvesting of hive products. This could be because of traditional perception that work meant originally for male ought to be done by male only. Out of the total (111) male beekeepers, only 22 (19.8%) allowed their wives to sell the harvested honey. As indicated in Table. 2, cleaning apiary, preparing fresh cow dung for smearing the hives and preparation of harvesting materials were activities in which women participation was relatively better than hive ownership, inspection, and honey harvesting. All of the male (111) beekeepers reasoned out that they allow women to participate in such activities because the activities are simple to perform. The results imply the dominances of male in controlling the benefit from the sector which could reduce the interests of the women involving in the sector.

Table 2. Participation of women in hive ownership and management in sample peasant associations in Chiro district of Western Hararghe Zone of Ethiopia.

Beehive ownership and participation in management	No of respondents	Man		Woman	
		Frequency	(%)	Frequency	(%)
Beehive ownership					
Traditional	119	111	93.3	8	6.7
Transitional	119	0	0	0	0
Modern	119	18	15.2	0	0
Participation in hive management					
Preparing beehives	111	111	100	0	0
Preparing fresh cow dung for smearing hives	111	13	11.7	98	88.3
Installing beehives	111	111	100	0	0
Inspecting beehives	111	111	100	0	0
Cleaning apiary	111	46	41.4	65	58.6
Preparation of materials for honey harvesting	111	0	0	111	100
Harvesting honey	111	111	100	0	0
Selling honey	111	89	80.2	22	19.8

3.4 Source of Foundation Colony and Purpose of Keeping Bees

As mentioned by the sampled respondents, the main purpose of keeping honey bees was for production of honey for household consumption and generation of income. Out of the total, 89% of the respondents kept their bees for generating income while 11% kept them for home consumption. The main sources of the foundation colony were three: Catching swarms, gift from family, and buying. As shown in Table 3, 44.5, 41.2 and 14.3% of the respondents obtained their colonies through gift from their families, catching swarms, and buying respectively. Even though obtaining colony through gift from family and catching swarms were indicated to be the highest (85.7%) source of obtaining bee colony to start beekeeping, it is not considered as a reliable source of bee colonies. This is because of the following three reasons: 1. Families would not give up their strong productive bee colonies for anyone. 2. Bee swarming from the traditional hives emerges accidentally and at any time of the day, most of the time when the farmers and members of their families are working in farm land or away from their homes, which would result in loss of their new swarms. The 3rd source of bee colony is buying from the other beekeepers. In the study area, bee colony buying and selling was practiced in five out of the six PAs. As mentioned above, only 14.3% of the respondents have got their bee colonies through buying. However, the types of bee colony purchased were not good since almost all (99.2%) of the beekeeper sell weak colonies that proved to be non-productive. The respondents indicated another problem associated with dependence on buying bee colonies to start beekeeping. This is related to the fact that even the weakest bee colonies would not be offered for sale at a time required by buyers since most beekeeping farmers (89.2%) sell bee colonies only in case they are confronted with critical financial problems. This means bee colonies would no be on offer in the market any as needed by would-be buyers. The respondents also indicated that they buy bee colonies by trekking long distances to remote villages where beekeeping is practiced, which poses difficulty of transpiration. The price of a bee colony ranges from 1300 - 2000 ETB with the mean price of 1385 ETB. The result of the three bee colony sources in the study area indicates absence of reliable bee colony sources and bee colony multipliers. This implies that there is a high market demand for bee colonies and dearth of supply at the same time. Therefore, governmental and non-governmental organizations working on beekeeping intervention should plan promotion of queen rearing and bee colony multiplication techniques.

3.5. Placement of Hives and Beekeepers' Preference of Hives

As shown in Table 3, the respondents placed their hives in four different places; in the house, under the roof of the house, in the garden and on trees in the garden. Most (53.4%) of the respondents in the study area kept the beehives under the roofs of their houses, 30.7% kept in the garden, 15.1% kept inside houses and 0.8 % kept on trees.

Figure

Table 3. Sources of bee colonies to start beekeeping at sampled peasant associations in Chiro district of Western Hararghe Zone of Ethiopia.

Name of PA		Source of bee colonies beekeeping			Total
	Amounts	Gift from family	Catching swarm	Buying	
Chirokala	Count	2	11	7	20
	% within PA	10	55	35	100
	% of Total PAs	1.7	9.2	5.9	16.8
Arbarakate	Count	7	8	5	20
	% within PA	35	40	25	100
	% of Total	5.9	6.7	4.2	16.8
Arbahore	Count	17	2	1	20
	% within PA	85	10	5	100
	% of Total	14.3	1.7	0.8	16.8
Madicho	Count	10	9	0	19
	% within PA	52.6	47.4	0	100
	% of Total	8.4	7.6	0	16
Ifabas	Count	7	11	2	20
	% within PA	35.3	55	15	100
	% of Total	5.9	9.2	1.7	16.8
Najabas	Count	10	8	2	20
	% within PA	50	40	20	100
	% of Total	8.4	6.7	1.7	16.8
Grand Total	Count	53	49	17	119
	% of Total	44.5	41.2	14.3	100

a)

b)

Figure 3. a). Bee hives kept in the house; b). Beehives being placed in a khat field in Chiro district of Western Hararghe Zone of Ethiopia

As indicated above most (68.5%) of the respondents keep their hives under the roofs and inside the houses due to fear of theft and for easy follow up by any of the household members. However, especially putting the beehives in the house and under the roof of the house poses 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 and honey harvesting. The farmers indicated that they relocate their children and domestic animals and livestock to neighboring houses to minimize the risk.

3.6. Absconding and Swarming

As all other livening organisms, honeybee colonies abandon their shelter, hives, at any season of the year for different reasons such as lack of bee forage, frequent disturbance by enemies, and predators and uncomfortable hive designs. Absconding incidence have occurred in all PAs of the study area and 50.2% of the respondents reported absconding of their bee colonies. Almost all of the absconding (99.4%) occurred from the traditional hives. However, the highest percentage of absconding from traditional hive was unlikely to be due to unsuitability of traditional hives for bee nesting but was due to a large sheer number (94.8%) of traditional hives registered in the study area. The reported causes for absconding of bee colonies as indicated by respondents were lack of forage (27.4% of the cases), incidence of pests and predators specially ants (62.8 % of the cases), lack of hive maintenance (8.6%), and bad weather condition (1.2%). As described by the respondents, the major absconding months of the year was March to May (67.9%), June to August (23%) and December to February (10.1%) (Table 4). According to the respondents' views, the main causes of the highest absconding rate between March to August was indicated

to be the cumulative effects of lack of forage for bee that would create favorable environmental conditions for attacks by pests and predators. The farmers also indicated that the cause of relatively lower (10.1%) absconding rate observed during December to February was mainly due to better availability of flowers in the area. From this result, it could be supposed that beekeepers should not remove all honey combs during honey harvesting if the colony is in traditional and transitional hives and should not harvest honey from the bottom box (brood box) of modern hives. Additionally, they should also inspect the hives more regularly and manage the colonies through prevention of pests and predators and provision of supplementary feed especially during the months of March to August.

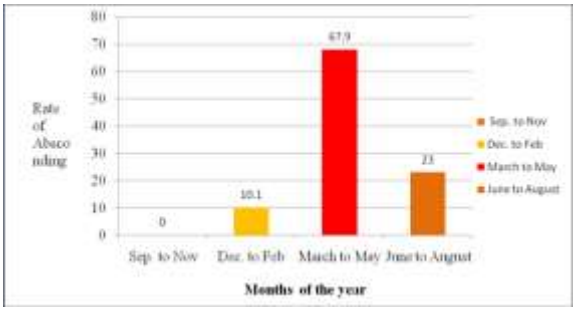

Figure 4. Time of the year when absconding highly occurs in Chiro district of Western Hararghe Zone of Ethiopia.

Swarming is the natural means of reproduction of honeybee colonies. In the process of swarming, the original single colony reproduces two and sometimes more colonies. As shown in Table 4, 65.5% of the respondents indicated the formation of swarms by their bee colonies while the rest, 34.5%, did not observe swarming. The 34.5% non-appearance of swarms did not totally imply absence of swarm formation. This could be due to the fact that beekeepers cannot know whether or not a colony of bees is preparing itself for swarming since internal inspection is not possible in traditional hives. On the other hand, any swarm leaves the hive at any time of the day most of the time when the bee-keeper or his/her family members are not present at home when elders are working in farm fields and juniors are perhaps running errands. Therefore, the real result of a swarm occurrence could be greater than the indicated figure. Concerning major swarming period of the year, 46, 52.3 and 1.7% of the respondents indicated September to November, December to February, and June to August to be major swarming months of the year. Accordingly, almost all (98.3%) of the respondents pointed out that September to February is the time of major swarm formations in the study area. These results indicate that if bee colonies are frequently inspected and followed up during September to February, a considerable number of swarms could be captured and prevented from leaving the hives, which can partly improve preservation of bee colonies

Table 4. Degree and season of bee swarming in sample peasant associations in Chiro district of Western Hararghe Zone of Ethiopia.

Variable	Peasant Association						Total
	Chiokala N(20) %	Arbarakate N(20) %	Arbahore N(20) %	Madicho N (19) %	Ifabas N(20) %	Najabas N(20) %	N (119) %
Occurrence of swarming							
Presnt	70	80	45	63.2	70	65	65.5
Absent	30	20	55	36.8	30	35	34.5
Swarm occurrence months							
Sep to Nov	65	95	20	15.8	40	40	46.0
Dec to Feb	35	5	80	84.2	50	60	52.3
March to May	0	0	2	0	0	0	0.0
Jun to Aug	0	0	0	0	10	0	1.7

3.7. 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). All of the respondents pointed out that they make external inspections of their hives sometimes, but none of them inspected their hives internally. Concerning the frequency of external inspection, 3.2 % of the respondents (beekeepers) visited their hives every day while 30.2% of them visited their hives once every week and the remaining ones (65.6%) visited their hives at least once during honey harvesting seasons to check if the hives have been colonized by bees. Internal hive inspection was totally unknown to the respondents and hence, none of them inspected to cheek the condition of the queen, production of additional queens to create new bee swarms, production level of brood, and

presence or absence of pests and disease. The respondents indicated that the major reason for absence of internal hive inspection was the impossibility of hive inspection under traditional beekeeping condition, and lack of knowledge on what activities or conditions of the bees in the hive need inspection. This result agrees with the findings of other researchers (Kerealem, 2005; Tesfaye and Tesfaye, 2007) who 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. About 52.7% of the respondents cleaned heir apiaries (areas around the hives) and put ash under the hive stands to avoid encroachment by small ants while the remaining 47.3% did not at all clean their apiaries.

Figure 5. Traditional hives invaded by weeds and exposed to attacks by pests and diseases in Chiro district of Western Hararghe Zone of Ethiopia.

During the survey, it was observed that most of the respondents (74.3%) did not properly manage their modern beehives. This might be due to lack of training and knowledge on improved beekeeping practices, lack of supervision or follow up by extension agents after distribution of the hives by donors. This could also be attributed to slovenliness of the beekeepers. About 74.3% of the modern hives did not have hive stands; they were merely placed directly on the ground (Fig 6 a. This condition would subject the hives to invasion and damage by weeds that cover the entrance of the hives (Figs. 5 and 6a). Only 25.7% of the respondents place placed their hives on hive stands and managed them relatively well. The overgrow weeds would dislodge pollen and nectars that the bees collected while they try to re-enter the hives.

a) b)

Figure 6 a. Modern hives placed directly on the ground in Chiro district of Western Hararghe Zone of Ethiopia; b. Modern hives places on hive stands in grasses.

3.8. Harvesting Honey and other Beehive Products

According to all respondents, honey is harvested at the time when beekeepers expect it to be ripe without any prior inspection. 67.4 % of the respondents indicated that they estimate the honey harvesting time simply by waiting for the end of flowering season while 33.6% use crowding of the entrance of hives by bees and smelling honey aroma as indicators of honey ripening. During honey harvesting from traditional hives, beekeepers cut and pull the fixed combs one by one. Pollen, brood, and honey combs were removed and all kept in the same container. Any comb pulled out of the hive (if it is empty) could not be returned. 67.4% of interviewed respondents used wood for smoking during harvesting while the remaining respondents (32.6 %) used cow dung. Almost all (98.3%) of the respondents used direct smoking using cow dung and/or selected wood during honey harvesting while only 1.7% of the respondents used modern smoker for producing smoke. The small percentage of using modern smokers is attributed to lack of awareness of farmers on existence of such a device. The farmers intimated to the researcher that sometimes using direct smoke was one of the causes for serious fire accidents.

During harvesting of honey from traditional hives, most of the respondents (83.7%) left some honey combs for the colony to prevent starvation, while 16.3% of the respondents harvested the whole content leaving the hive empty. In the study area, honey is harvested two times a year provided that bees did not abscond and/ or migrate before the second honey fallow season. The majority of the respondents (73%) collect large amounts of honey once during November to December in a year followed by twice (25%) during the mentioned time and May and June. This might be attributed to the difference in availability of abundant flowering plants between the two seasons. This result also agrees with the finding of Nuru (2007) who indicated these months as the two main honey flow and harvesting periods of the year. In the first honey harvesting period, the main reason for availability of honey in larger quantities might be attributed to the presence of flowering crops and flowering plants while

in the latter period, potential flowering ability of different plants could be the major reason. The average honey yield in the survey area was 7.64 kg/colony from traditional hives (ranging from 5 kg to 12 kg/colony) while the annual average honey production was 39.1 kg/year /available colonies/household (ranging from 6 kg to 67 kg/year).

As indicated by all of the respondents, bees wax is not harvested for utilization. The crude wax is harvested with honey and then broken down and sold together with the crude honey. After cutting the combs from the hive, if it has no any honey or is dry, the farmers destroy it either by burning or burying in the soil. According to the respondents, the main reasons for not collecting beeswax were lack of knowledge on the importance as well as its complex processing system. Only 2 of the 119 respondents knew that wax could be processed and sold at local and international markets. Wax is one of the most expensive and highly demanded bee products whose price is about three times more than the price of pure honey. All of the respondents had not any awareness and even did not hear other bee products; bee pollen, propolis, royal jelly and bee venom, could be produced and marketed. The result could suggest that improved practice-oriented training and awareness creation should be delivered to the farmers of the study area to produce at least some of the hive products and generate additional income from beekeeping.

3.9. Honey Bee Pests and Predators

Based on the result of this study, the existence of pests was a major challenge faced by farmers in beekeeping activities. The farmers indicated that ants, wax moth *(Galleria mellonella)*, lizard, spider and honey badger and birds were the most harmful pests in decreasing order of importance (Table 5). Similar findings were reported by Solomon (2009) in the central and southeastern 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 Gondar province in Ethiopia. This survey revealed that 59.1% and 21.4% of respondents observed ants and wax moth as serious problems that frequently weaken the strength of the colony and resulted in absconding. Some of the respondents (46.8%) indicated placing ash under the hive stands and cleaning the apiary as a good preventive system against ants while the remaining 53.2% could not totally control the ants. The result implies that research should be conducted to find better ways of controlling ants and wax moths in honey production.

Table 5. Pest and predators of honey bees in Chiro district of Western Hararghe Zone of Ethiopia; b. Modern hives places on hive stands among grasses.

Major pest and predator	Total sample (n=120)	
	Percent	Rank
Ants	59.1	1
Wax moth	21.4	2
Lizard	11.8	3
Spiders	7.7	4
Honey badger	5.4	5
Birds	3.2	6
Total	100	

3.10. Challenges faced in beekeeping in the study area

Each bee-keeper involved in the study was requested to prioritize the challenges mentioned. Accordingly, inadequate knowledge and practical skills (technical shortcomings), lack of bee colonies, poor extension service and pest and predators were found to be the top four challenges for beekeeping in the area. The detailed results are summarized in Table 6. Thus, shortage of bee colonies was the second most important challenge in the study area. Some of the respondents who were members of beekeeping cooperatives indicated that they have 20 modern hives from NGO called CISP but due to lack of bee colonies, they kept the hives empty for two years without any function. This implies the necessity of queen rearing and colony multiplication technology intervention to alleviate the problem in the study area. According to the respondents, although the extension service workers told them the importance of using improved hives and technologies, no one practically demonstrated to them how to use them or the whole operational systems, which is from colonizing the hives with bees to harvesting the products. These problems may lead to low yield and quality honey produced in the area and inefficient utilization of both modern and traditional beehives that exist in the study area. According to discussions made with some of the development agents (DAs) working in the study area, some of the major reasons for lack of technical support were lack of skill on modern hive operations as a result of absence of practical oriented training programs, absence of incentives that would consider the nature of beekeeping management, in which case hive operation is done after regular working time (after 6:00 pm).

Table. 6 Major challenges identified by respondents in the district in Chiro district of Western Hararghe Zone of Ethiopia; b. Modern hives placed on hive stands among grasses.

No	Constraint	Degree of problem (%)
1	Lack of knowledge	29.6
2	Lack of bee colonies	26.1
9	Poor extension service	12.5
3	Pest and predator	9.3
4	Lack of beekeeping equipment	7.6
5	Lack of bee forage associated with deforestation	6.4
6	Absconding	4.3
7	Application of chemicals	2.1
8	Poor storage facilities	1.2
10	Drought	0.6
11	Market problem	0.2
12	Disease	0.1
	Total	100

4. Conclusions

The results of this study have demonstrated that honey production is widely practiced by farmers in the study area in which both men and women participate. However, the results have indicated that there are a number of problems that lower both the yield and quality of honey and its products obtained by farmers. This is attributed mainly to shortage of bee colonies, inadequate technical know-how and practical skills to properly manage hives and bee colonies, high price of modern hives and their accessories, lack of practically supported extension services on modern beekeeping technologies, incidences of pests like ants and wax moths, low participation of women due to dominance by men, and seasonal availability of bee forage and flowers. The results imply that extension supports are required to be given to honey producing farmers by providing different technologies and enhancing their knowledge and skills through training to improve management of beehives and enhance the yield and quality of honey and its products. There is also a need to educate farmers on producing diverse honey bee products especially wax as well as producing new bee colonies through queen rearing. Future research needs to look into eliciting concrete information on better and adaptable ways of managing honey bees under farmers' conditions, including hive and colony management as well as production of wax and rearing of bee queens.

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