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Assessment on the Constraints & Practices of Beekeeping, and Post-Harvest Honey Handling in Gesha District, Keffa Zone, South-West Ethiopia

Getachew Abraham*

Department of Animal Science, College of Agriculture Science, Ethiopia

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***Corresponding author:** Getachew Abraham, Department of Animal Science, College of Agriculture Science, Arba-Minch University, Ethiopia, Email: gechoabraham@gmail.com

Abstract

The study was conducted in Gesha district, Keffa zone, SNNPRS of Ethiopia to assess the current practices & constraints of beekeeping, and post-harvest honey handling. A total of 160 respondents' were selected randomly from four purposively selected localities based on beekeeping potential & interviewed using semi structured questioner. Data were analyzed using SPSS version 21 software. The study revealed the majority of the respondents (60%) in the district practiced traditional beekeeping only. The average annual honey yield per hive from traditional beekeeping observed significance difference ($p>0.05$) for the localities; however from transitional & movable frame hive, it observed no significance difference. The average annual honey yields per hive from traditional, transitional & modern beehive were 8.62kg, 13.13kg & 19.91kg respectively. Pest & honey bee enemies, herbicide poisoning, absconding of bees, and lack of appropriate knowledge to manage bees were found the major constraints of beekeeping in the study area. Furthermore, Ants, monkey, honey badger, birds, spider, wax moth, & lizards were identified the major damaging bee pest in the district. Despite all these constraints, there is an immense potential to enhance the quantity & quality of honey yield in the district. Strong extension & technical intervention, appropriate cultural practice to manage weeds & plant pests, training to enrich the knowledge of beekeepers, improve post-harvest honey handling, and prevention of deforestation should be conducted to enhance the quantity & quality of honey yield in the area.

Keywords: Beekeeping practice; Herbicide poisoning; Bee pest; Constraints; Post-harvest honey handling

Introduction

Beekeeping in Ethiopia is a promising non-farm activity which contributes to the incomes of households and the economy of nation. It also provides an employment opportunity for the household, however the exact number of farmers engaged in the sub-sector in Ethiopia is not well known. It is estimated that around one million farm households are involved in beekeeping business [1].

Beekeeping in Ethiopia has recently attracted attention because of its potential to help revitalize the economy, reduce poverty, and conserve forests. The European Court of Justice in 2011 ruled that honey containing pollen from genetically modified plants could not be sold in the European Union [2,3], which gives Ethiopia an advantage over other major honey-exporting countries since most Ethiopian honey is free from genetically modified plants as well as pesticides and other agrochemicals [4].

However, the country hasn't been producing adequate table-honey for local and export markets; since the sub sector has been seriously devastated by complicated constraints. Low productivity and poor quality of hive products are the major economic impediments for beekeepers [5].

The prevailing production constraints in the beekeeping subsector of the country would vary depending on the agro ecology of the areas where the activities is carried out Ayalew [6]. Variations of production constraints also extend to socio-economic conditions, cultural practices, climate (seasons of the year) and behaviors' of the bees [7]. However, beekeeping research conducted in the nation so far did not cover to characterize and document the apicultural resources and associated constraints of the sector for its proper intervention and utilization to specific potential regions [8]. Southwest parts of the country in general and Gesha district in particular has an immense potential for beekeeping. The place is endowed with diversified agro climate & honey bee plants. The presence of long flowering period with bimodal rain fall pattern makes the bees to produce & reproduce twice a year in the region [5]. However, there is no much detailed documented information about the current practice &

constraints of beekeeping. Therefore, the objective of this study was to investigate the beekeeping practices, post-harvest honey handling and constraints of beekeeping in Gesha districts.

Research Methodology

Description of the study area

The study was conducted in Gesha district, Keffa zone, SNNPRS. Gesha is among the 13 districts in Keffa zone & is located 538km west of the capital Addis Ababa and 126km from the capital of the zone, Bonga. Gesha suffers by poor infrastructural facilities like road & electricity. The altitude of the district ranges from 1500-3000m. The area has a varying topography composed of steep, mountains, and plateau area that covers 25%, 50% and 25% respectively (Annual report of the district, 2014). Gesha is bordered on the south by Bita district, on the west by the Sheka Zone, on the north by the Oromia region and Sayilem district, and on the east by Gewata district.

The area is characterized bimodal rain fall pattern having the mean minimum & mean maximum annual rain fall is 1750 & 2200mm respectively. It has a humid climate having the mean maximum and mean minimum temperature of 24 °C and 14 °C respectively. The farming system is characterized as mixed crop-livestock production system. The soil type of the area is dominantly Nitisols with clay loams in texture and acidic in reaction which is agriculturally productive.

Study design

The research was basically a retrospective and cross-sectional survey focused on the selected localities of Gesha district. The sampling units were households keeping honey bees.

Method of sampling & sample size

Four localities namely 'Yerkceti', 'Xiraro', 'Meshami', and 'Dirbedo' were selected purposively based on their beekeeping activity & access for transport. A random sampling technique was used to select sample respondents. A total of 160 respondents (40 respondents from each locality) from the four localities were selected randomly.

Methods of data collection

Both primary and secondary data were used for the study. The primary data were collected by using semi structured questionnaire, observation and focus group discussion with local farmer, and development agents. Key informants interview was also conducted to generate qualitative information about the activity. Key informants included model beekeepers, elders, and DAs working in Gesha district. Secondary data was gathered from officials working in various GOs, and NGOs found in the district & various reports.

Methods of data analysis

The collected data for the beekeeping practice, bee colony inspection, constraints of beekeeping, bee pest & enemies, absconding of bees, function of beekeeping, post-harvest honey handling, and status of honey bee flora were analyzed by using simple descriptive statistics. Results are presented mainly in the form of descriptive tabular summaries'. The analysis was conducted separately for each locality in the district. The collected data for the average annual honey harvest were analyzed with one-way ANOVA. When the analysis revealed the existence of significant difference among means, Tukey test was used to separate significant means. Significant differences were declared at $P<0.05$. SPSS version 21 statistical software was used to analyze the data.

Result and Discussion

Household characteristics

The household characteristics' of the respondents' are presented in Table 1. Majority of the respondent household were men headed (96.9%) and the remaining (3.1%) were female headed. In the district the activity is predominated by traditional method embracing local hives with indigenous knowledge. The traditional hives are hanging on big tree branches in which some of the trees are as long as 40 meters and above. Female cannot climb up such big trees and hence discouraged to engage in the activity. The study substantiate [4] reported traditional beekeeping in Ethiopia is men's job. The majority age of the respondent in the study area ranges 31-40 years (37.5%). Peoples in the aforementioned age do have the skill & strength to climbing big trees and uplift the hive to hang on branches of big trees. This result substantiates people in the most productive age engage in the beekeeping activity. The survey also indicated that the majority of the respondents (92.5%) were married. Marriage promotes synergy within a farm family and function as a custom to cop up life challenges in the rural community.

Table 1: Household characteristics of the sample households (%)

Variable	Category	Yerkceti (n=40)	Xiraro (n=40)	Meshami (n=40)	Dirbedo (n=40)	Overall (n=160)
sex	Male	95	97.5	97.5	97.5	96.9
	Female	5	2.5	2.5	2.5	3.1
Marital status	Married	95	92.5	92.5	90	92.5
	divorced	5	2.5	2.5	5	3.8
	Single	-	2.5	2.5	-	1.3
	Widowed	-	2.5	2.5	5	2.5

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Age	<30	25	45	32.5	37.5	35
	31-40	45	32.5	30	42.5	37.5
	41-50	17.5	7.5	22.5	10	14.4
	>51	12.5	15	15	10	13.1
Education	Read &write	77.5	62.5	57.5	77.5	68.8
	Illiterate	22.5	37.5	42.5	22.5	31.3

Out of the total interviewed beekeepers, about 68.8% of the respondents can read & write and the remaining 31.2% were illiterate. In the study area the activity is predominated by traditional practices since the majority of the respondents hardily understand new technologies. Educational level of the farming households is critical to understand extension packages' and adoption of improved technologies which in turn determine the development of the community. Gichora [9] noted that for more advanced beekeeping, one should have a good grasp of bee biology & behavior of bees for better colony management.

The current Beekeeping Practices

Type of beekeeping

The type of beekeeping practiced in the district by the respondents is presented in Table 2. Based on their level of technological advancement, three distinct types of beekeeping were used by the sample respondents in the study area as the investigation revealed. Accordingly large proportion of the respondents (60%) practiced traditional beekeeping only whereas 25.6% of the respondents practiced traditional & transitional beekeeping concurrently; and the remaining (14.4%) practiced traditional & movable frame hive beekeeping concurrently. It is also observed that the beekeepers used locally available material and indigenous knowledge to make traditional hives. Traditional hive made by drilling of a piece of tree trunk called log hive is very common in the area. The financial & technical constraints dodge the development of improved beekeeping in the area as indicated by the respondents. However some NGOs & district livestock & fishery development office promote improved beekeeping and convinced some farmers to practice it. The current study was in agreement with Beyene and David (2007) who reported traditional, intermediate, and modern beehives are used for honey production in Ethiopia. The outcome of the investigation in-line with other finding conducted in Central, Northern and South Western part of Ethiopia where traditional beekeeping system is the predominance in the rural areas of the country. Furthermore, MoARD [10] reported that finance and gaps in operational skills have constrained the adoption of frame beehives by beekeepers.

Table 2: Type of beekeeping in the district (%) by sample respondents.

Type of the Hive	Yerkceti (n=40)	Xiraro (n=40)	Meshami (n=40)	Dirbedo (n=40)	Overall (n=160)
Traditional only	60	70	57.5	52.5	60
Traditional & transitional	32.5	15	25	30	25.6
Traditional & frame hive	7.5	15	17.5	17.5	14.4

Movable frame hives allow appropriate colony management and use of a higher level technology, with larger colonies, and can provide higher yield and quality honey but are likely to require high investment cost and good operational skill [11].

Honey yield

Table 3: Honey yield (kg) from traditional, transitional and movable frame hive in the study area by sample respondents.

Localities	Traditional hive Mean (kg) + SE	Transitional hive Mean (kg) + SE	Frame hive Mean (kg) + SE
Yerkceti	7.45+0.22a	12.9+0.29	19.0+0.73
Xiraro	8.75+0.19b	13.6+0.38	20.9+0.83
Meshami	9.53+0.16c	13.0+0.30	19.8+0.66
Dirbebdo	8.75+0.16b	13.1+0.40	19.8+0.80
Overall mean	8.62+0.109	13.1+0.17	19.9+0.39
p-value	0.000***	0.54 NS	0.380 NS

The average annual honey yield per hive from traditional, transitional & modern bee hive for Yerkceti, Xiraro, Meshami & Dirbebdo localities is presented in Table 3. The average honey yield from traditional beekeeping was significantly highest ($p<0.0001$) for Meshami (9.53+0.160) kg/year/hive & lowest for Yerkceti (7.45+0.221) kg/year/hive. However, no significant difference was observed in Xiraro & Dirbebdo localities. The variation of average annual honey yield per hive from traditional beekeeping in the localities was attributed to the difference in the volume of the hive & the skill of the beekeeper. Traditional

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beekeeping is mainly practiced with different types of traditional hives that are very much diversified in shape, volume and the materials used depending on the cultural differences and the local materials available for construction [10]. The variation in average annual honey yield per hive in different area might be attributed to the variation in the potentiality of the area, the management & experience of the beekeeper. Gidey (2011) reported productivity and overall production increases with the level of management, experience and area potentiality. According to the report of CSA [12] an average of 5-6kg honey/hive/year could be harvested per year in the country which is lower than the current study.

The average annual honey yield/hive from transitional & modern beehive for the localities observed no significant difference. This might be due to the governmental & non-governmental organization that have been working to develop the subsector provided transitional & movable frame hives having similar volume. The average annual honey yields per hive from traditional, transitional & modern beehive in the current study were 8.62kg, 13.1kg & 19.9kg, respectively. However, Gebretsadik et al. 2016 reported that the average annual honey yield per hive from traditional, transitional and modern beekeeping in Gedeo zone was 13.6kg, 19.8kg and 22.0kg, respectively which is higher than the present study.

***significant at P<0.001, **significant at P<0.01, NS= non-significant at P>0.05, means with different letter of superscript in the same column differ significantly.

Placement of the beehive

The sheltering & placement of beehive of sample respondents in the study area is presented in Table 4. As the study revealed, most beekeepers (55%) in the district hung their hives on trees away from the homestead in dense forest whereas 23.1% of the respondents hung on trees near the homestead. Considerable portion of the respondents (13.8%) kept their beehive in the backyard. Only small proportion of the respondents (1.9%) kept their hive in areas of enclosure. The prevailing honey production system in the district is based on traditional beekeeping technique dominated by forest and backyard beekeeping. Beekeepers in the district prefer to hang their bee hive in dense forest far away from residential area where there is ample bee forage & bee swarm abundant.

Table 4: Placement of bee hive (%) by sample respondents

Variable	Category	Yerkceti (n=40)	Xiraro (n=40)	Meshami (n=40)	Dirbedo (n=40)	Overall (n=160)
Placement of beehive	Hanging on trees near the homestead	22.5	27.5	22.5	20	23.1
	Backyard	12.5	7.5	17.5	17.5	13.8
	Hanging on trees away from the homestead	57.5	55	45	62.5	55
	Under the eaves of the house	2.5	7.5	15	-	6.3
	In areas of enclosure	5	2.5	-	-	1.9
Sheltering beehive	Yes	20	5	17.5	27.5	17.5
	No	80	95	82.5	72.5	82.5

The result of the current study is substantiated by Kidane [13] who reported that about 68.4%, of farmers in Godere district placed their beehives on branches of tree in the dense forest far away from their residential areas whereas the 12.4% of the respondents' hung on trees near homestead & about 19.2% of respondent beekeepers hung on trees in forest and near homestead, respectively. The author also stated more than 85% of the traditional hives in Godere district are hung in the dense forest which are mostly far away from residential areas and have limited hive visit to only one or two times until harvesting. Furthermore, GDS [14] reported the largest portion of honey produced in the country comes from forest trees.

Of the total interviewed, 82.5% of the respondents didn't shelter their bee hive & about 17.5% of the respondents did. Poor (lack) of hive sheltering expose the colony for extreme weather condition so that the colony suffers to maintain hive temperature and thus reduce honey production. Low sheltering trend might be attributed to the prevailing forest beekeeping practice, the lack of knowledge and lack of financial resource. The shelters were made from locally available materials (wood & leaves).

Apiary visit & hive inspection

The apiary visit & hive inspection of the respondents in the study area is presented in Table 5. The investigation revealed 43.1% of the respondents were visited the apiary occasionally just to check the presence of the hive & to check the hive was occupied by bee swarm. About 36.3% & 20.6% of the respondents visited the apiary sometimes & regularly respectively to check the colony is safe. The current study agrees with Kebede & Tadesse 2014 who reported the majority of respondents inspect the hive occasionally.

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Table 5: Apiary visit & Beehive inspection frequency (%) of sample respondents.

Variable	Category	Yerkceti (n=40)	Xiraro (n=40)	Meshami (n=40)	Dirbedo (n=40)	Overall (n=160)
Apiary visit	Regularly	15	15	20	32.5	20.6
	Sometimes	37.5	40	42.5	25	36.3
	Checking the presence of the hive (occasionally)	47.5	45	37.5	42.5	43.1
Colony inspection	Internal & external hive inspection	12.5	15	17.5	15	15
	External hive inspection only	40	40	45	42.5	41.9
	No colony inspection	47.5	45	37.5	42.5	43.1

Of the respondents conducted inspection, 41.9% conducted external hive inspection only; whereas 15% of the respondents' conducted internal & external hive inspection. This disagrees with Tessega [15] who reported 46.7%, 20.6% & 7.5% of the respondents in Bure district conducted internal hive inspection rarely, every month & every fortnight, respectively (Table 6).

Table 6: Major honey bee floras in the district by sample respondents.

Vernacular name	Botanical name	Flowering period
Wanza	*Cordia Africana*	Feb. – May
Getema	*Schefflera abyssinica*	March – May
Sesbania	*Sesbania sesban*	Jan – March
Bisana	*Croton macrosttachys*	Feb – April
Grawa	*Vemonia amygdaline*	Jan – march
Kulkual	*Euphorbia candelabrum*	Dec. – Feb.
keybahirzaf	*Eucalyptus camadulensis*	March – April
Coffee	*Coffee Arabica*	August – Jan
Mango	*Mangifra indica*	Jan – April
Adeyabeba	*Bidens sklp*	August – Oct.
Maize	*Zea mays*	Feb- march
Avocado	*Persea Americana*	October – jan

Internal hive inspection was conducted by farmers practicing improved beekeeping & undertaken during honey harvesting; swarming seasons, and when there was suspicion of bee pests & the like. External hive inspection were conducted to assess the status of the honey bee colonies and to check the neatness of the apiary. Kebede & Lemma 2007 reported that internal hive inspection of traditional hive is not easy and common due to the inconvenience of the hive design. Similarly, Kidane 2014 reported that the inappropriateness of traditional hive for internal inspection make the management of reproductive swarming impracticable.

Honey Bee Flora & feeding practice of bees

Table 7: The trend of honey bee flora (%) in the study area by sample respondents.

Status of bee Flora	Yerkceti (n=40)	Xiraro (n=40)	Meshami (n=40)	Dirbedo (n=40)	Overall (n=160)
Stable	12.5	12.5	25	22.5	18.1
Decreasing	87.5	80	72.5	72.5	78.1
Increasing	-	7.5	2.5	5	3.8

Some of the major honeybee floras of the district in vernacular (common) and botanical names with their flowering periods are presented in Table 7. The investigation revealed that the honeybee flora of the study area comprises of trees, shrubs, herbs and cultivated crops which are a source of nectar and pollen. This variation in vegetation characteristics of the area could be substantial to secure ample pollen and nectar vital for reproduction of bees & production of honey. The present study is in agreement with Chala et al. [8] who reported similar composition of honey bee plants in Gomma district. Nuru [16] also described, the honeybee population and their productivities in general are mainly influenced by the nature of honeybee

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flora of an area. The resources supplied by plants are important sources of nectar, pollen and Propolis; some are also important for hive construction while others used in local procedures for scenting new hives to attract swarms.

The interviewed beekeepers also reported many cultivated crops in the area serve as pollen, nectar or both pollen and nectar sources. Mainly shrub, forbs, herbs, weed, cultivated crops and some woody plant are the main bee forges for the honey harvested in October to November while most woody plant are the main source of pollen and nectar for honey harvested in March to May. The major annual honey yield in Gesha area is originated from *"Getema" (Schefflera abyssinica)* which often blooms from February to May.

Shortage of bee forage is the common phenomenon during off-flowering seasons even though the area is blessed with diversified honey bee flora as indicated by the respondents. 78.1%, 18.1% & 3.8% of the respondents indicated that bee plants in the past decade have been declining, stable, and increasing respectively. The variation of the land scape might be attributed with different rate of deforestation & land clearing for crop cultivation could contribute to the disparity on trend of honey bee flora. Flat & Plateau areas are cleared more for caltivetion and more prone to deforestation than steepy areas so that liable for decrease trend of bee flora. The current study agrees with Kebede & Tadesse 2014 who indicated 60% of the respondents reported bee forage become declining as compared with the past due to deforestation & expansion of cultivated lands in Hadiya zone. Similarly Karan et al. 2013 reported that depleting floral resources has reduced the beekeeping potential.

The Feeding practice of Honey Bees

The trend in feeding honey bees of the respondent farmers in the study area is presented in Table 8. The study indicated that only 30.6% of the respondents practiced feeding of honey bee during dearth period & the remaining 69.4% of the respondents never feed honey bees. The respondent beekeepers that practiced improved beekeeping feed their bees during the off-flowering season of major honey bee plants. Beekeepers in Ethiopia rarely practice feeding honey bees. Most beekeepers in the study area believe that honey bee naturally sustain by themselves and produce honey via foraging from natural forest and cultivated crops.

Table 8: Trend in feeding of honey bees (%) by sample respondents.

Variable	Category	Yerkceti (n=40)	Xiraro (n=40)	Meshami (n=40)	Dirbedo (n=40)	Overall (n=160)
Supplementary feeding	Yes	30	20	40	32.5	30.6
	No	70	80	60	67.5	69.4
Type of supplementary feed	Sugar syrup	7.5	5	15	10	9.4
	Roasted pea & bean flour	17.5	10	12.5	15	13.8
	Honey	5	5	12.5	7.5	7.5
	Don't feed	70	80	60	67.5	69.4

Beekeepers in the study area use different types of feeds for feeding honeybees. Among the respondents who practiced feeding of honey bees, 13.8%, 9.4% & 7.5% of the respondents provided roasted pea & bean flour, sugar syrup, and honey, respectively during the dearth period. The result is substantiated by Shenkute et al. [17] who reported no provisions of supplementary feeds at the time of sever feed shortage in traditional practices of forest beekeeping, however only few who involved in intermediate beekeeping supplement bees sugar syrups and roasted pulse flour in south west Ethiopia.

The Major Constraints of Beekeeping

Table 9: Major Constraint of Honey Production (%) in the study area by sample respondents

Constraints	Yerkceti (n=40)	Xiraro (n=40)	Meshami (n=40)	Dirbedo (n=40)	Overall (n=160)
Herbicide poisoning	45	30	30	22.5	31.9
Pest & honey bee enemies	45	35	40	42.5	40.6
Absconding of bees	5	25	20	20	17.5
Lack of appropriate knowledge	5	10	10	15	10

The major constraints of beekeeping in the study area are presented in Table 9. The major constraints of beekeeping as indicated by respondents were pest & predator of honey bees (40.6%), herbicide poisoning (31.9%), absconding of bees 17.5%, & lack of appropriate knowledge to manage bees (10%). The present study is substantiated by Gidey et al. [18] who reported that bee pests, predators and absconding are major constraints affecting honey sub-sector in northern Ethiopia. Variations of production constraints also extend to socio-economic conditions, cultural practices, climate (seasons of the year) and behaviors' of the bees [7].

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Honey Bee Pests and enemies

The major honey bee pests & enemies identified in the study area are presented in Table 10. Like all living organisms honey bees are vulnerable to pests & predators in all stages of their life cycle. The study revealed that the existence of pests & predator was a major challenge of beekeeping. Of the interviewed, 41.3% of the respondents reported and attack in their apiary. Gesha district is endowed with natural forest with a humid climate which inhabits various organisms that could spoil the life of honey bees. The study is substantiated by many researchers who found ant attack is the most serious problem in beekeeping subsector [6,19]. Other bee pests & predators identified in the area as reported by the respondents were Monky/ape (21.9%), honey badger (19.4%), birds (5%), spider (4.4%), lizard (3.8%), and wax moth (4.4%). Likewise Challa [20] ranked ants, wax moth, honey badgers are 1st, 2nd & 3rd bee pests & enemies respectively those affect bees & beekeeping in Ethiopia. Similarly, Shenkute et al. [17] reported that the major honeybee enemies found in Keffa, Sheka & Bench-Maji zone are ants, honey badgers, birds and small hive beetles. The author also reported that the honeybee enemies are causing great losses (40.7%) of total honey production per annum. This indicates honey bee pests and enemies have significant impact on the income of the beekeeping household.

Table 10: Honey bee pests and predators (%) in the district by sample respondents

Pest & Enemies	Yerkceti (n=40)	Xiraro (n=40)	Meshami (n=40)	Dirbedo (n=40)	Overall (n=160)
Ant attack	52.5	35	35	42.5	41.3
Monkey/apes	22.5	22.5	22.5	20	21.9
Honey badger	10	17.5	17.5	32.5	19.4
Birds	7.5	5	7.5	-	5
Spider	2.5	10	5	-	4.4
Lizard	2.5	7.5	5	-	3.8
Wax moth	2.5	2.5	7.5	17.5	4.4

The respondents also indicated the various traditional methods they have been using to avoid honey bee best & enemies. They apply ash & used engine oil on the hive stand to avoid ants; covering the hive stand with thorny plants & corrugated iron sheet was used to keep away monkey & honey badger from reaching the bee hive.

Absconding of bee colonies

Table 11: Absconding of bees (%) by sample respondents

Variable	Category	Yerkceti (n=40)	Xiraro (n=40)	Meshami (n=40)	Dirbedo (n=40)	Overall (n=160)
Occurrence of absconding	Yes	92.5	92.5	90	95	92.5
	No	7.5	7.5	10	5	7.5
Cause of absconding	Pest & enemies	27.5	25	27.5	32.5	30.4
	Food shortage	20	12.5	27.5	15	20.3
	Destroying of nest during honey harvesting	35	30	20	27.5	30.4
	Unknown reason	10	25	15	20	18.9
Control mechanism of absconding	Overall management	77.5	77.5	75	62.5	73.1
	None	22.5	22.5	25	37.5	26.9

The study revealed that 92.5% of the respondents experienced the absconding of honey bee colony. Various causes of absconding were identified in the present study (Table 11). Accordingly pest & enemies (30.4%), destroying the nest during honey harvesting (30.4%), food shortage (20.3%), & unknown reason (18.9%) are the reasons for absconding as indicated by the respondents. The present study is in agreement with Chala et al. [8] who reported similar reason 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 period of major honeybee plants. The 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

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the colony results in the eventual absconding of the colony. This is in agreement with Shenkute et al. [17] who testified similar results in Keffa & Sheka zone.

Of the interviewed, 73.1% of the respondents stated improving the overall management (cleaning the apiary, feeding bees during dearth period, appropriate harvesting technique etc) as an approach to avoid absconding. On the other hand 26.9% of the respondents thought absconding was unavoidable and hence done nothing to stop it. These farmers believed that once the colony is disturbed for honey harvesting, it tends to abscond and never stay in the hive.

Post-harvest honey handling

The investigation revealed that the purpose of honey production in the study area is for commercial and/or home consumption (Table 12). Of the interviewed, 78.8%, 19.4% & 1.9% of the respondents' reported the purpose of honey production were commercial only, commercial & home consumption, and home consumption only respectively. SNV (2011) reported that about 10% of the honey produced in the country is consumed by beekeeping households. The remaining 90% is sold for income generation; of this amount, it is estimated that 70% is used for brewing tej and the balance is consumed as table honey. The respondents also indicated beekeepers that have no critical financial problems keep their honey for extended period of time to get better price for the honey. This is in agreement with Kebede & Tadesse (2014) who reported that 75% of the households do not store honey primarily due to high demand for cash but some farmers keep some amount for various purposes. Beekeepers sell the largest proportion of their honey during harvest at low price mainly to meet their demand for cash for social obligation [1].

Table 12: Honey handling containers in the area (%) by sample respondents.

Variable	Category	Yerkceti (n=40)	Xiraro (n=40)	Meshami (n=40)	Dirbedo (n=40)	Overall (n=160)
Purpose of honey production	Commercial only	80	80	87.5	67.5	78.8
	Commercial & home consumption	20	17.5	10	30	19.4
	Home consumption only	-	2.5	2.5	2.5	1.9
Honey handling container	Clay pots	7.5	12.5	20	22.5	15.6
	Plastic container	37.5	40	30	20	31.9
	Plastic sack	37.5	25	30	32.5	31.3
	Kil (local container)	17.5	22.5	20	25	21.3

The investigation also revealed the beekeepers in the study area used various types of containers to handle honey (Table 12). The containers used to handle honey as indicated by the respondents in the area were plastic container (31.9), polyethylene sack (31.3), kil (21.3%), & clay pot (15.9%). The farmers in the study area used local made containers & poor quality plastic container for honey storage which contributes the deterioration of honey quality. The current study agree with Shenkute et al. [17] who reported similar containers used to handle honey in Keffa, Skeka & Bench-Maji zone. Farmers use traditional containers which are technically substandard storage facilities which result in quick crystallization & fermentation of honey; eventually change the general appearance & test of honey.

Conclusion

Beekeeping has been practiced as a sideline activity in the area by many rural farming communities as a livelihood activity & income generation. The prevailing honey production system in the district is based on traditional beekeeping technique dominated by forest and backyard beekeeping which compromise the quantity & quality of honey. Attempts have been made by government & NGO to introduce transitional & movable frame hive in the district however the adoption rate is low. Moreover, various constraints namely honey bee pest & enemies, herbicide poisoning, absconding of bees and lack of appropriate knowledge to manage bees have been hampering the development of the activity in the area. Furthermore, Ants, monkey, honey badger, birds, spider, wax moth, & lizards are the major damaging bee pest in the district. Despite the various constraints, it is impossible to ignore the activity due to its contribution for the livelihood & food security of the farming community as well as its invaluable function in maintaining the natural resources of the area. Moreover, there is an immense potential to enhance the quantity & quality of honey yield in the area to improve the livelihoods of the communities in a sustainable manner. Therefore, all stakeholders in the area should work in the integrated manner for the development of the sub-sector to benefit the farmers in particular & the country in general [21-24].

Recommendation

Based on the findings of this study, the following recommendations are forwarded:

a. Strengthening the extension services & technical intervention in the area to enhance the development of improved beekeeping that can significantly increase the quantity & quality of honey yield.

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b. Encourage the farmers to employ appropriate & timely indigenous agricultural practices against plant pests & weeds that can minimize the use agrochemical that could harm the honey bees in the area.

c. Provision of standard honey storage container with affordable price to the beekeepers in the area can minimize the use substandard container that exposes the honey for deterioration.

d. Avoid deforestation & create awareness about the value of non-timber forest products should be conducted to boost the quantity & quality of honey yield in the area.

Conflict of Interest

The authors declare that they have no conflict of interest.

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