



Beekeeping Practices and Honey Marketing in West Guji Zone, Oromia Regional State, Ethiopia

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Abstract

The aim of the study was to assess beekeeping practices and honey marketing in Bule Hora and Dugda Dawa district West Guji, Oromia Regional State's, Ethiopian. The study area was selected purposively and multiple-stage sampling approaches were employed to select 120 households (HH). Descriptive statistics were applied to analyze the qualitative and quantitative data, which were generated via semi-structured questioning, focus group discussions, and key informant interviews. The study result showed that traditional beekeeping was dominant, and majority (90.54%) of the respondents using traditional hives. Also, the majority of respondents (69.15%) obtained their colonies by trapping swarms. In Bule Hora district, 66.7%, and in Dugda Dawa district, 62.5%, of the respondents place their traditional hive hanging on a tree near their homestead, but only 13.3% of the respondents provide supplementary feed for their bee's colony during the dearth period. The number of traditional hive owned per household was significantly different ($P < 0.05$), Bule Hora was lower (3-4) than Dugda Dawa (12-15) district. Majority (75.83%) of the respondent harvest honeys were twice per a year. Average honey yield obtained per hive per year from traditional, transitional and modern hive was 6.39, 10.88 and 13.18 kg respectively. The mean price of crude honey marketed in Eth. birr with maximum 204.05 and minimum 111.65. The index ranked analysed result showed that honey badger (0.44), ant (0.32) and wax moth (0.11) were the most important economic pest and predators that affect beekeeping productivity in the area. Moreover, poor marketing systems and honey quality also result in limited growth for the subsector. Despite the availability of a significant potential for the beekeeping subsector, which does not contribute as expected to the livelihood of the communities due to a lack of improved hives, pest and predator, skill gaps and honeybee forage availability were a major factors which hinder beekeeping in the area. To improve the productivity of beekeeping, awareness creation, the provision of an improved hive, and the provision of capacity building training on modern beekeeping as well as on how the beekeepers control common pests and predators should be considered.

Key words: *Beekeeping, Constraints, Honeybee, Marketing*

1. INTRODUCTION

Across the globe, beekeeping provides several invaluable benefits to farming societies. The practice of honeybee production is deeply rooted within the Ethiopian farming community. Today, the country is the number one honey and beeswax producer in Africa and belongs to the top ten worldwide (FAOSTAT, 2020). The diversified agro climatic conditions of the country create environmental conditions conducive for the growth of over 7000 species of flowering plants of which most are bee plants (Birhanu, 2016; Yetimwork et al., 2015). The annual honey production in Ethiopia was estimated around 50,000 tons in 2018 (FAOSTAT, 2020), owns 5.89 million of honeybee colonies (CSA, 2020). In respect of the country's agricultural GDP, beekeeping contributes 1.3% (Akessa, 2016). In 2016/17, 95.4% of all hives in the country were traditional, while 1.3% was transitional and 3.3% were modern hive systems, respectively. Two years later, the total number of beehives increased by 14.3% to 7.1 million hives in the country (Kristina et al., 2021). Unlike large-scale beekeepers using modern techniques found in most leading honey-producing countries, the majority of Ethiopian beekeepers are small-scale producers practicing traditional beekeeping (Kristina et al., 2021). Based on the type of beehives used, the production system can be traditional (fixed-comb), transitional (top-bar) or modern (frame) (Ayalew, 2008). Traditional beekeeping is dominant which is practiced in forest or backyard (Nuru, 2002). Honey collected from traditional and transitional hives is usually inferior in quality compared to honey collected from modern hives (Alemayehu et al., 2015).

These days, it is well known that beekeeping is a sustainable and high potential activity for local communities to gain additional income (Fikadu, 2019). The direct contribution of beekeeping includes honey and beeswax (MoARD), 2007). Owing to increase in income and human population, there is large growing demand for natural products like honey and other bee products for its high nutritional and/or medicinal values (Sebsib, 2018). Generally in the countries, great proportion of the people depends on agriculture as a source of income (Kristina et al., 2021). Around one million households are involved in beekeeping business using traditional, intermediate and modern hives and honey was marketed at local and urban areas for human consumption and *Tej*-making (Haftu et al., 2015). Bule Hora and Dugda Dawa districts of west Guji zone Oromia regional state are believed to be potential areas for beekeeping development as they have good climatic conditions and diversified bee flora. But, there is no compiled and reliable information which indicate the current status of beekeeping practiced

in the area and honey marketing. For any developmental strategies to respond for prevailing constraints understanding of the production systems and product marketing is very essential (Alemayehu et al., 2015). Therefore this study was designed to assess beekeeping practices and honey marketing in west Guji zone, Oromia regional state, Ethiopia.

Specific Objectives

- To investigate honeybee production system practiced in the study area
- To describe honey marketing in the study area
- To identify major challenge which affect honeybee productivity in the study area

2. MATERIALS AND METHODS

2.1. Study Area Description

The study was conducted in Bule Hora and Dugda Dawa district, west Guji zone, Oromiya regional state, Ethiopia. The area is found at a distance of 467km and 497km away from Addis Ababa to south direction for Bule Hora and Dugda Dawa districts respectively. Bule Hora is located in an altitude ranges from 2000-2400, and Latitude 5°18.4695'N, Longitude 38°17.1654'E. While Dugda Dawa district which is located at altitude a range of 1500-1700 meter above sea level 5°35' N Latitude and 38°15'E Longitude (West Guji zone Administration Office, 2020). The livelihood dependence of Bule Hora district community was by mixed crop livestock farming system. While the people who live in Dugda Dawa district were mainly get income from rearing a livestock. Figure 1 shows the map of the study area.

2.2. Study Design

Multi-stage sampling techniques were used. Out of ten districts of the zone; two districts namely Dugda Dawa and Bule Hora were selected purposively; based on their production potential, accessibility and budget availability. To generate all necessary information required from both district six rural *kebele*¹ were selected. The *kebele* was stratified based on their production potential as high, medium and low. Accordingly Bule-Kanya, Muri-Turkuma and Ropi-Magada rural *kebele* were selected

¹ *The smallest administrated unit in Ethiopia*

from Bule Hora district. While Came Kura, Hema Kinsho and Jigesha Nanesa *kebele* was selected from Dugda Dawa district.

2.3. Sample Size and Sampling Techniques

A total of 120 respondents HH were selected, individual respondent from each *kebele* were selected randomly. Socio-economic character of the HH, hive type used, season of honey harvest, honey marketing and the most common challenge which affect beekeeping practices data were collected from both primary and secondary data sources. Semi-structured questioner both open and close ended type was developed; it was translated to Afan Oromo then pre-tested before the actual work. To clarify and minimize biasness of the data gathered and to get the overall beekeeping practices of the study area; district level expert and development agent from each district were used as a key informant and three focus group discussions were conducted with 8-15 elders in each district.

2.4. Data Management and Analysis

Both quantitative and qualitative data was analyzed using Microsoft excel and Statistical package for social science (SPSS) version 20. Then descriptive statistical tools such as percentages, mean, frequency and standard deviation was used to present the data. The statistical differences between means value were declared at $P < 0.05$. The results were presented in the form of tables. Musa et al (2006) index ranking method was employed to analyze the most important economic pests and predators, which affect honeybee production in the area. It was calculated as rank index = sum of (3*number of household ranked first + 2*number of household ranked second + 1*number of households ranked third) for individual reason, criteria or preference divided by sum of (3*number of household ranked first + 2*number of household ranked second + 1*number of households ranked third) for over all reason, criteria or preference.

3. RESULTS AND DISCUSSION

3.1. Household Demographic Characteristics

Table 1 shows the demographic characteristics of the respondent in the study area. The study result shows that majority (85.83%) of the respondents was male headed households and the remaining were female headed households. This might be due to the participation of beekeeping as it is the main role and responsibility given for the male headed HH. This study investigation is similar with the investigation at the various parts of the country illustrating that Ethiopia traditionally beekeeping is men's job in Sothern Ethiopia (Alemayehu et al., 2022). Concerning the marital status of the respondent's majority (97.50%) of the respondents was married. Similar results have reported the majority of beekeepers sampled from Dessie district are married (Addisu and Desalegn, 2021). Out of sampled respondent from both district majority (60%) of the respondents was illiterate and respondent have educational background above high school was only (2.5%). The finding was higher with ERSS (2013) survey report with a value of 54.5% illiterate farm household heads; at national level. Educational level of the beekeepers can have a significant impact in identifying and determining the type of development and extension services that need to be designed for the area and significantly affect the probability of adoption (Abeje et al., 2017). Therefore, improvement of education access in both districts will need great attention to improve honeybee productivity in the area. The majority (48.33%) of the respondents follows protestant religion and followed by *Waqeffata* religions which account 30.0%.

3.2. Age of the Respondents and Household Family Size

Table 2 illustrates the age and households family size. The age range of the respondent in Dugda Dawa district was from 18-80, whereas the respondent age varies from 22-70 in Bule Hora district. In both district majorities (55%) of the respondents were found at 18-40 age group which show beekeeping were practices by productive and economically active age group suggesting high potential labor availability for beekeeping. Based on Ethiopian age group classification, 15-64 age groups are considered as working labor force (ERSS, 2013). The mean value of the family' size was 8.53 ± 0.40 (*mean* \pm *SE*). This finding is in line with Tesege (2009) study done in Amaro district, the average number of family members was 8.43 ± 0.40 (*mean* \pm *SE*). Large family sizes have a better chance for labor shares in farm activities and hence for beekeeping activities too. The mean value of the family size of the sampled respondent which was found at age category of 0-14 was 3.96 and 4.77

in Bule Hora and Dugda Dawa district respectively. This implies that about 50% of the population in the study area was dependent on the labour force and other means of living.

3.3. Source of Income

The survey result indicates that the source of income of the community in the study area depends on production system they practices. Many farmers practice beekeeping as a supplementary income-generating activity. Mixed crop-livestock farming was the dominant (65.8%) source of income in Bule Hora district and wheat, maize, teff, coffee and *Enset* were the crop type cultivated in the area. While maize, pulse and teff were crop type cultivated and livestock rearing was the means of household income in Dugda Dawa district. The contribution of off-farm activities in both district ranked the second source of income which account 13.3-18.3%. Majority (80.8%) of the respondent in the study area practices beekeeping as a primary source of income (Table 5).

3.4. Beekeeping Practices in the Study Area

The survey result indicates that, beekeepers practices beekeeping for a long period of time 5-25 years to improve their economic status. Beekeeping can make farmers' livelihoods more resilient by easing their credit constraints when coping with shocks. Income from beekeeping could also support investment in their agricultural inputs, pay for their children's schooling, and smoothing consumption. In addition to its nutritional value honey has a medicinal and cultural value in the study area. Traditional beekeeping practice was dominant; in Bule Hora the type of hive used account 87%, 6% and 7% for traditional, transitional and modern hive respectively. While in Dugda Dawa 94.09%, 3.88% and 2.03% of the respondent uses traditional, transitional and modern hive for honey production (Table 4). The result is consistent with CSA (2009) reported as at national level traditional beehives account for about 97% of the total honeybee produced. Also the study done in Horo district revealed that majority about (96.2%) of the respondents use traditional production system (Alemayehu et al., 2022).

The study result shows that in Bule Hora (66.7%) and Dugda Dawa (62.5%) honeybee colony was hanged on the tree near homestead (Table 4). Moreover in Bule Hora district few numbers of respondent 9(15%) were placed traditional hive on the tree in the forest. On the other hand in Dugda Dawa 21.4% of the respondents hang their traditional hive on the tree in the forest. According to

Addisu and Desalegn (2021) study in Dessie Zuria districts of Amhara Region more than 80% of total bee colonies are managed being placed in the backyard.

The number of traditional bee hive owned per household was significantly different at 5% ($P < 0.05$), at average 3-4 and 12-15 for Bule Hora and Dugda Dawa district respectively. The finding in line with Addisu and Desalegn (2021) finding the average bee colony holding size in Dessie is 5.13 per a beekeeper. Out of 120 sampled beekeepers from both districts, 69.15% started beekeeping by catching bee swarms, while the remaining 27.5% was get bee colony from gift from their parents (Table 3). It is in line with Alemayehu et al. (2022) report 66.3% of the beekeepers in Horo district started beekeeping by catching bee swarms.

3.5. Honey Productivity in the Study Area

Table 5 shows the trend of honey productivity and harvesting frequency. The beekeepers perception on the current trend of honey productivity in the area for the past five years (2008-2012) indicates, most of the respondents in Bule Hora (53.3%) and Dugda Dawa (70%) stated that honey productivity became declining. The finding agree with Areda (2015), reported that bee forages become declined as compared with the past period due to forest degradation, use of herbicides and expansion of cultivated lands in Guji zone. Generally honey yield produced per harvest was depending on honeybee forage availability and level of management. The productivity of honey was also lower due to the production system followed was traditional. The findings agree the productivity is low because beekeeping practiced is dominated by traditional low-input and output practices: fewer than 5% of beekeepers own modern beehives (CSA, 2020). Majority (86.7%) of the respondent do not supplement their honeybee colony during dry season (Table 3). It indicates that there is a skill gap on honeybee colony management practice which affects the overall productivity of honey. Hence honey yield obtained can be depending on the colony management practices (Kajobe et al., 2009; Yirga and Teferi, 2010).

The harvesting frequency varies among respondents; due to the honeybee flora availability and level of management. Around 65% and 86.67% respondents harvested twice per year in Bule Hora and Dugda Dawa district respectively. Only 10.82% of the respondents were harvest honey three times per a year in the study area. But the study done by Gebrehaweria et al. (2018), about 40.9% of the sampled respondents reported as they were harvest four times per year. The quality of honey harvested was generally low; due to this the price of honey was lower. This result was in line with Hartmann (2004) finding in our country large extent of marketed honey quality is lower and used for locally called

'*Taji*'² preparation. Moreover, low productivity and quality of bee products are among the major economic impediments for beekeepers in Ethiopia (Alemayehu et al., 2022).

The study result indicates that in Bule Hora at average 4.28 kg and 8.37 kg of crude honey was harvested from traditional and modern hive/year respectively. While in Dugda Dawa at average 8.5 kg and 18 kg of crude honey was harvested from traditional and modern hive/year respectively (Table 7). The variation may be associated with the agro-ecological condition of the area and the size of hive used. Also the types of honeybee colony (species) which adapt the mid-altitude and low land are not the same including in their production potential. The result is consistent with national average from traditional 5–8kg is harvested (Gemechis, 2016). Moreover, it is less as compared with from modern hives Horo district, which is about 22.54 kg of honey, was harvested (Alemayehu et al., 2022).

3.6. Honey Marketing Practiced in the Study Area

Table 6 indicates the distance travel to reach market center and market information source. The accessibility of market center was also the other challenge reported by respondent HH. The respondents travel at minimum for 5.6 and maximum 42.25 km to reach the market center. Due to that the producers are forced to sell their hive product (honey) at nearby local market. Even the available market is not well-organized which need great attention for the future. The finding result is higher as compared with Afar region, an average distance of 7.4 km from their residence to the nearest market place (Gebrehaweria et al., 2018). Honey selling was the responsibility given of men at both district. Regarding to market information source; majority (90.45%) of the respondents get information from different sources about honey market. Nearby farmers and other sources like telephone were the main sources of information in the area. The technical advice that was given for the respondent from extension agent was extremely low. Only 9 (7.8%) of the respondent get market information per a year from development agent. It indicates the producer doesn't get all necessary advanced and improved technology.

Table 7 indicates overall honey yield and price of honey. Beekeepers in the study area market honey in urban and local market. According to the study result the price of honey is subjected to price fluctuation with the highest price is from November to December and lowest in July to August. Also,

² *Boka/Teji is traditionally fermented product prepared locally*

the mean price of crude honey marketed in Ethiopian birr with minimum 111.65 and maximum 204.05 respectively. The price fluctuation was mainly associated with the availability of honey forage and honey quality. According to Areda (2015) study in Guji zone during July to August the moisture content of the honey is higher and also it is a peak flowering period. During honeybee forage availability is higher the possibility of production of honey will be higher. Then the price of honey will be lower. Also the type of crop cultivated throughout the year is different. The flavor of honey is depends on the honeybee forage types available in the area which determines the price and customer preference. The price of crude honey was better as compared with western Ethiopia reported in 2015; the average price of crude honey in local markets per kg was 45.5 Ethiopian birr (Alemayehu et al., 2015).

3.7. Constraints which affect honeybee productivity

The survey result indicates that in Bule Hora district the interviewed beekeepers index ranked analyzed result indicates that pesticide application for agricultural activity can affect their honeybee productivity seriously, pests and predators and limited availability of improved beekeeping equipment's was 0.43, 0.21 and 0.11 respectively. But in Dugda Dawa the major challenge which affect honeybee productivity in the area was pest and predator (0.28), honeybee forage availability (0.21), and inaccessibility of market center (0.15) (Table 8). The result of this study in line with other scholars honeybee disease, pests and predators, lack of skilled man power, shortage of honeybee forage, marketing problems and high cost of the hive are some of the constraints which affect honeybee productivity in the country (Ayalew, 2008; Desaleny, 2016; Haftey et al., 2018). Hence, the government or any developmental organization should give attention for the sector on alleviating the prevailing constraints in providing improved hive with its accessory and awareness creation on pest and predator control is important.

3.8. Economic Important Pest and Predators in the Study Area

Table 9 shows the summary of index ranked result of the most economic important pest and predators in the study area. Indexed ranking result showed that honey badger was the first predator which challenges the beekeeper 0.44 and the second most serious bee enemy was the presence of ant 0.35 in the area. The beekeepers witnessed that their bee colonies suffered from honey badger which resulted in death of adult honeybees then finally result to absconding of colon. Many research findings also confirmed pests and predators as major threatening factors for honeybees and beekeeping business (Adebay et al., 2012; Gebremeskel et al., 2015; Kumsa and Takele, 2014). Moreover honey badger and

wax moth is the top ranked pest and predator type identified in traditional bee hive at western Ethiopia (Alemayehu et al., 2015). During focus group discussion the elders stated as so far the beekeepers have their own traditional knowledge used for a long period of time on honeybee pest and predators. Currently such type of endogenous knowledge that was practiced before in the area was not widely used.

4. CONCLUSION

Beekeeping was practiced for a long period of time and traditional production systems were dominant. Majority of the respondent HH in the area start beekeeping by catching the swarm. Honey yield from traditional, transitional and modern hives varied across the districts. Proportionally majority of the respondent were harvest honey twice per a year. They practice beekeeping mainly to get money from honey selling. Majority of the respondent sell honey at Bule Hora and Finchawa town market center. The price was decided by negotiation between producers and customer. The quality of honey marketed was lower as majority of honey was harvested from traditional hive. There was a skill gap on honeybee colony management practices like supplementary feeding during dry season and construction of shelter. The extension services delivered in relation to honey marketing not to be as such satisfactory to the desired extent.

Honey badger, ant and wax moth were the most economically important pest and predator types in the area. The most common constraint which affect honeybee production in the area were; application of pesticide/insecticide, pest and predators, shortage of honeybee forage, lack of improved honeybee technologies, market accessibility and lack of awareness. Therefore, to improve honey productivity in the future provision of consistent and practical based capacity building training on identified skill gap for beekeepers is recommended.

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LIST OF TABLES

Table 1 Demographic character of the respondent in the study area

Demographic character of the respondent by District (N=120)							
Socio-economic information	Parameter	Bule Hora		Dugda Dawa		Overall	
		Freq.	%	Freq.	%	Freq.	%
Gender	Male headed HH	55	91.7	48	80	103	85.83
	Female headed HH	5	8.3	12	20	17	14.17
Marital status	Married	58	96.7	59	98.3	117	97.50
	Single	0	0.0	1	1.7	1	0.83
	Divorced	0	0.0	0	0.0	0	0.00
	Widowed	2	3.3	0	0.0	2	1.67
Educational level	Illiterate	33	55.0	39	65.0	72	60.00
	Basic	8	13.3	14	23.3	22	18.33
	Primary	13	21.7	2	3.3	15	12.50
	Secondary	1	1.7	4	6.7	5	4.17
	Above secondary	2	3.3	1	1.7	3	2.50
Religion	Muslim	7	11.7	3	5.0	10	8.33
	Orthodox	13	21.7	4	6.7	17	14.17
	Protestant	24	40.0	34	56.7	58	48.33
	<i>Waqeffata</i>	16	26.7	20	33.3	36	30.00

Source: own survey result, 2020

Table 2 Household family size and Age of the respondent

Household Family Size and Age of the Respondent (N=120)			
Variable	Parameter	Name of District	
		Bule Hora (Mean \pm SD)	Dugda Dawa (Mean \pm SD)
HH Family Size by age category	Less than 15	3.96 \pm 1.16	4.77 \pm 3.20
	Greater than 15-64	4.37 \pm 2.24	4.55 \pm 4.15
	Greater than 65	1.0 \pm 0	0.58 \pm 0.97
Respondents Age	Minimum	22	18.00
	Maximum	70	80.00
	Std. Deviation	13.9	11.85

Source: own survey result, 2020

Table 3 Honeybee colony source and honeybee feeding practices in the study area

Source of honeybee colony and supplementary feeding during dry season (N=120)									
Variable	Parameter	Bule Hora		Dugda Dawa		Average			
		Freq.	%	Freq.	%	Freq	%		
Source of honeybee colony	Gift from parent	21	35	12	20	33	27.5		
	Catching swarms	35	58.3	48	80	83	69.15		
	Buying	4	6.7	0	0	4	3.35		
Supplementary feeding during dry season	Yes	11	18.3	5	8.3	16	13.3		
	No	49	81.7	55	91.7	104	86.7		

Source: own survey result, 2020

Table 4 Honeybee management and colony size in the Study area

Honeybee management practices in the study area by district (N=120)															
Variable	Parameter	Bule Hora						Dugda Dawa							
		Traditional		Transitional		Modern		Traditional		Transitional		Modern			
		N	%	N	%	N	%	N	%	N	%	N	%		
Hive management	Backyard with simple shade	11	18.3	31	51.2	10	10	0	0	10	16.1	33	54.6	10	100
	Hanging on the trees near home stead	40	66.7	25	41.5					38	62.5	22	36.5		
	Hanging on trees in forests	9	15	4	7.3					13	21.4	5	8.9		
Colony size	The number of hive	588	87	46	6	40	7			111	94.09	46	3.8	24	2.0
										5		8		3	

Source: own survey result, 2020

Table 5 Frequency of honey, primary target of beekeeping and honey productivity in the Study area

Source of honeybee Colony and frequency of harvesting in the Study area (N=120)							
Variable	Parameter	Bule Hora		Dugda Dawa		Overall	
		N	%	N	%	N	%
Frequency of harvesting honey time/year	One	13	21.7	3	5.00	16.0	13.35
	Twice	39	65.0	52	86.67	91.0	75.83
	Three	8	13.3	5	8.33	13.0	10.82
Primary target of beekeeping	For consumption	10		16.7		23.0	
				13		21.7	
						19.2	

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	For market	50	83.3	47	78.3	97.0	80.8
Respondent perception on beekeeping productivity	Increase	11	18.3	13	21.67	24.0	19.98
	Decrease	32	53.3	42	70.00	74.0	61.68
	Unknown	17	28.3	5	8.33	22.0	18.34

Source: own survey result, 2020

Table 6 Source of market information and responsibility of honey marketing in the Study Area

Source of market information and gender responsibility in the Study area (N=120)							
Variable	Parameter	Bule Hora		Dugda Dawa		Overall	
		N	%	N	%	N	%
From where do you get market information	Nearby beekeeper	56	93	44	73.3	100	83.15
	Development Agent	1	2.3	8	13.3	9	7.8
	Other	3	4.7	8	13.3	11	9
Do you get honey market information	Yes	57	94.2	52	86.7	109	90.45
	No	3	5.8	8	13.3	11	9.55
Honey selling responsibility	Men	48	80.2	56	93.3	104	86.75
	Women	12	19.8	4	6.7	16	13.25

N.B: Other source includes Tv, Radio and mobile phone

Source: own survey result, 2020

Table 7 Honey yield, price of honey and market accessibility in the Study Area

Honey productivity and honey marketing in the study by district (N=120)				
Variable	Parameter	Bule Hora (Mean)	Dugda Dawa (Mean)	Overall mean
Honey yield /hive/ year	Traditional	4.28	8.5	6.39
	Transitional	5.56	16.2	10.88
	Modern	8.37	18	13.185
Price of honey at local market per kg in ETB	Maximum	233.45	175	204.05
	Minimum	135.45	87.5	111.65
How much Km. do you travel to reach market center	Minimum	6.2	5	5.6
	Maximum	23.5	61	42.25

Table 8 Major beekeeping production constraints identified in the study area

Major honeybee production constraint in the study area (N=120)				
Types of constraints	Name of District			
	Bule Hora		Dugda Dawa	
	N	Index	N	Index
Pests and predators	28	0.21	29	0.28
Chemical	51	0.43	14	0.14
Limited availability of improved beekeeping equipment's	26	0.11	19	0.12
Honeybee forage availability	16	0.07	33	0.21
Lack of awareness	22	0.10	18	0.11
Inaccessibility of market center	18	0.08	14	0.15

Source: own survey result, 2020

Table 9: The most important economic pests and predators in the study area

Rank index for major economic pest and predator in beekeeping in the study area (N=120)				
Pest and Predators	Rank			Index
	1 st	2 nd	3 rd	
Honey Badger	43	18	9	0.44
Ants	24	21	15	0.32
Bee-eating birds	-	-	6	0.02
Wax moth	3	11	14	0.11
Mice	-	5	16	0.07
Lizard	-	2	9	0.03
Beetles	-	-	4	0.01

Index= Sum of (3 times rank 1 + 2 times rank 2 + 1 times rank 3) given for individual reason, divided by the sum of (3 times rank 1 + 2 times rank 2 + 1 times rank 3) for over all reasons.

LIST OF FIGURES

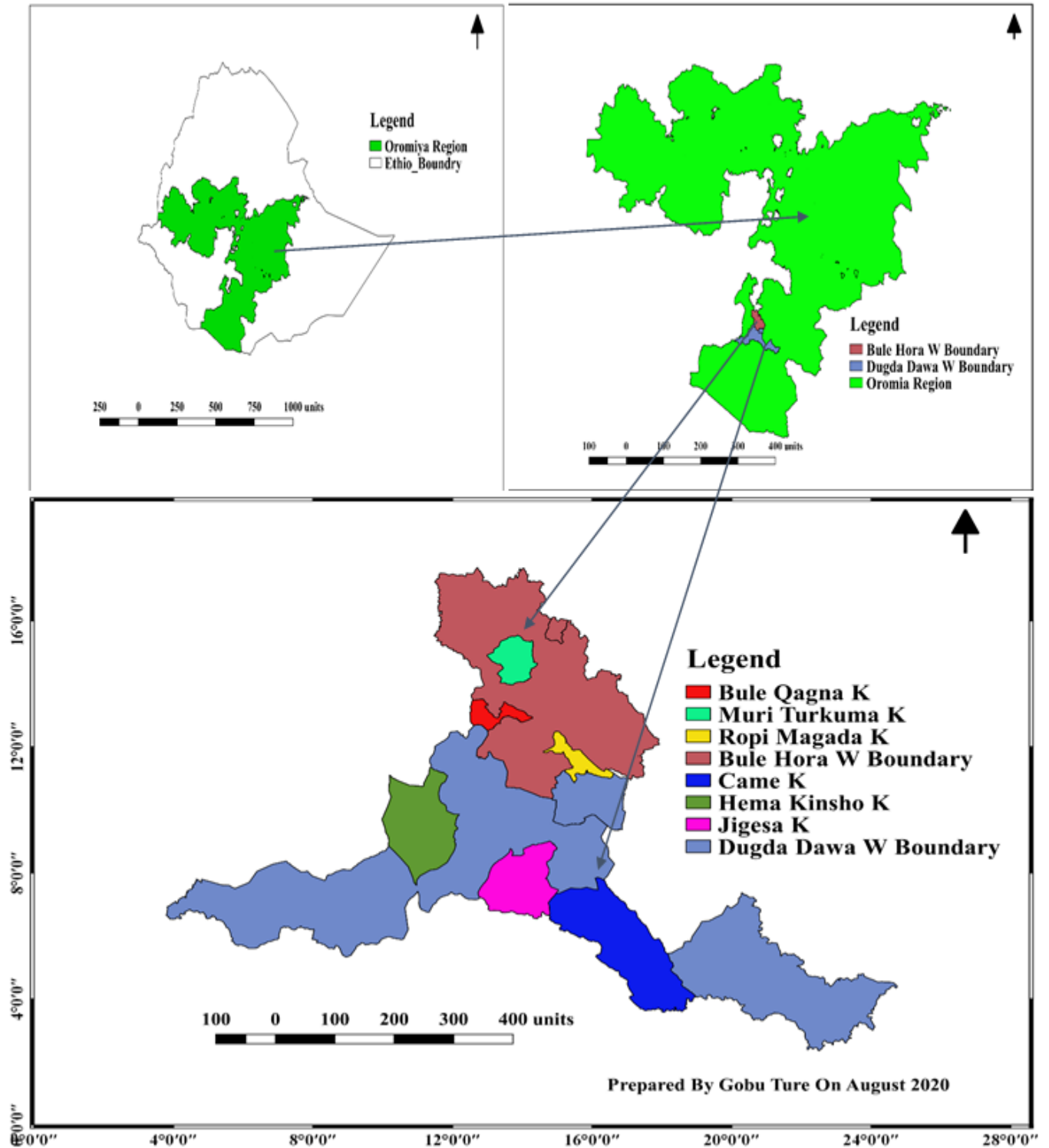


Figure 1: Study Area Map