

Research Article

# Assessment of Beekeeping Practices in Selected Urban Areas of East Shewa and West Arsi Zones of Oromia, Ethiopia

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## Abstract

The beekeeping status of urban land was assessed in Sheshemene, Wondo, Negele Arsi, Bishoftu, Modjo and Batu urban areas of Oromia regional State, Ethiopia. Data were collected from purposively selected 130 urban residents through a formal survey. The survey was covered about 81.7% of men respondents in all the urban beekeeping areas and the highest percentage (30%) of the respondents were found in secondary schools. Most of the respondents (70%) in the study area were practicing modern beekeeping of which about 35.9% were owned an average of five bee colonies. In the study area, 83.3% of the respondents were owned private honeybee colonies in urban areas. The majority of respondents (34.9%) have had a bee farm for more than 15 years. The majority of respondents (68.3%) were gathered the honeybee colonies through purchasing and only 8.3% were accessed swarm catching. About 76.9% of beekeepers “sometimes “visit their bees, and the rest beekeepers did not visit or inspect their bees at all. About 33.8% of the beekeepers visit their bees only externally, and 23.1% of beekeepers were visit occasionally. The main constraints of beekeeping in the urban areas were the lack of bee equipment, bee pests and diseases, the lack of improved beekeeping skills and extension services. In general, the present study revealed information on the status and challenges of beekeeping in urban areas. Improving urban beekeeping and the assessment of its potential in urban areas are a vital for future study. Moreover, urban beekeeping should also be supported by trainings and extension services.

## Keywords

Keeping Practices, Traditional, Transitional, Modern Hives

## 1. Introduction

Urban agriculture and food production have been recently experienced and gain a great attention [1] In response to concerns about the safety and sustainability of our existing food systems, many people in urban areas are looking for ways to produce more of the food they eat within the urban areas [2]. Like any other agricultural practices, beekeeping sector is

steadily growing in urban areas. Urban apiculture is defined as a group or collection of beehives established in an urban society [3] and [4]. Advocates argue that urban beekeeping can be a safe and healthy practice with a number of environmental, economic, and social benefits, for practitioners and urban areas [2].

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**Received:** 27 January 2025; **Accepted:** 26 March 2025; **Published:** 19 April 2025



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A variety and range of ecological and socio-economic benefits have driven the idea of urban apiary establishment across the world [4]. The establishment of the apiaries ensures the creation of employment opportunities for people around the urban community, which could counter the common characteristic on mass rural to urban migration [5]. A number of non-governmental organizations and some government offices have lately been advocating for urban apiary establishment to ensure environmental conservation, urban forests in particular and to restrain the issue of unemployment in the urban areas [6].

In many African countries, unemployment and poverty remain a pressing issue and urban beekeeping has a potential solution to solve these challenges [7]. For example, the beekeeping industry in South Africa, Cape Town, with appropriate flora space and showed its potential to flourish and generate employment opportunities for the informal settlements and township unemployed residents.

Historically, Ethiopia has been a country with diverse flora and fauna resources in Africa. But due to expansion of crop farming and destruction of forests for years in the country, honey plant species and bee forages has been under continuous destruction. As a result, the productivity of beekeeping has been shrinking in many parts of the country, particularly in rural areas. To the contrary, in the recent years, urban forestation and greening program has been underway in Ethiopia by both government and non-government organizations, to create resilient against climate change in urban areas.

This action has significantly increased vegetation cover and diversity in urban landscapes which can possibly be integrated with different urban farming practices. Urban beekeeping is one of the urban farming systems which have been practiced in different urban areas of Ethiopia. However, there is little or absence of research based evidence on the extent of urban beekeeping practice and its productivity, including the profitability of the urban beekeeping in Ethiopia in general and in Oromia in particular. Therefore, this research was designed to assess the status, potentials, and determination of productivity of beekeeping in selected towns of East Shewa and West Arsi zones of Oromia region, Ethiopia.

## 2. Materials and Methods

### 2.1. Study Sites

The study was conducted in purposively selected urban areas of East Shewa and West Arsi zones of Oromia, Ethiopia. Six towns (Bishoftu, Modjo and Batu towns from East Shewa zone and Sheshemene, Wondo Genet and Negele Arsi towns from West Arsi zone) were purposively selected based on beekeeping potential.

### 2.2. Modalities of the Study

Twenty to thirty residents per selected urban areas were se-

lected based on the availability of beekeeping practices and based on their interest. Accordingly, a total of 130 individual respondents were selected. For this study, beekeepers selection and sampling was done through collection of prior information from respective urban agriculture cluster office of each selected town.. Then, pre awareness was given to the selected beekeepers about the objectives of the study and how the study will help for the sustainable development of urban beekeeping activities.

### 2.3. Method of Data Collection

Data was collected using both semi-structured and structured questionnaires. The questionnaires were pretested before collection of actual research data. Group Discussion and Key informant interview techniques were also employed. In this study both primary and secondary sources of data on the beekeeping production system, opportunities, and major challenges were used. Primary data were collected on socio-economic characteristics (household characteristics, educational status, landholding, and number of bee colony), beekeeping situation (beekeeping experience, source of bee colony, reasons of engagement in beekeeping, number of honeybee colony owned, placement of bee colony, and types of hives), major challenges (colony decline, absconding and swarming, honeybee pests and predators, and training and extension service), and available opportunities. Secondary data were used to select potential locations based on the number of honeybee colonies and honey production.

### 2.4. Method of Data Analysis

Data was entered into MS excel spread sheet, checked for outliers and cleaned before imported into SPSS version 16 software for analysis. Descriptive statistics like mean, mean deviation, frequency and frequency percentages were used for analysis of the data. Tables and bar charts were used for reporting of results in this study. Analysis of variance (ANOVA) was also conducted to analyse some aspects of the data.

## 3. Results and Discussion

### 3.1. House Hold Characteristics

The result of educational level of the respondents was presented in Table 1. Majority (81.7%) of the respondent households were men headed at all the beekeeping urban areas while the remaining (18.3%) were female headed.

The maximum percentage (30%) of the respondents' educational level in the current study was categorized under the 'Secondary school' educational level, while the minimum percentage (2.22%) of their educational level was categorized under higher educational level of Diploma, Degree, MSc or MA. Understanding the educational level of the farming households is critical to determine the acceptance and adoption of improved technologies and extension pack-

ages' which in turn determine the development of the sector. In line with this, [8] explained that for more advanced bee-

keeping, one should have a good grasp of bee biology & behavior of bees for better colony management.

**Table 1.** Household characteristics of the sampled respondents (%).

Educational levels	Urban Areas						Overall
	Shashamane	Wondo	N/Arsi	Bishoftu	Modjo	Batu	
Male	80.00	75.00	85.00	83.33	66.67	100.00	81.66
Female	20.00	25.00	15.00	16.67	33.33	0.00	18.33
illiterate	3.33	70.00	60.00	13.33	10.00	0.00	26.11
Primary	20.00	15.00	15.00	33.33	26.67	30.00	23.33
Secondary	30.00	5.00	25.00	33.33	40.00	65.00	30.05
Diploma	6.67	0.00	0.00	10.00	13.33	5.00	5.83
BSc/BA	13.33	0.00	0.00	6.67	6.67	0.00	4.44
MA/MSc	6.67	0.00	0.00	3.33	3.33	0.00	2.22

The age range of the respondents is given in Table 2. The average maximum percentages (33.0.05%) of the respondents in the present study were fallen in the age range of 36-45, whereas the average minimum percentage of respondents fell in the age range of above 65.

**Table 2.** Average percentage (%) of age categories of respondents in the study urban areas.

Age categories	Urban Areas						Overall
	Shashamane	Wondo	N/Arsi	Bishoftu	Modjo	Batu	
18-25	3.33	70.00	60.00	13.33	10.00	0.00	26.11
26-35	20.00	15.00	15.00	33.33	26.67	30.00	23.33
36-45	30.00	5.00	25.00	33.33	40.00	65.00	33.05
46-55	6.67	0.00	0.00	10.00	13.33	5.00	5.83
56-65	13.33	0.00	0.00	6.67	6.67	0.00	4.44
Above 65	6.67	0.00	0.00	3.33	3.33	0.00	2.22

It was also indicated that majority (66.7%) of the respondents in the current beekeeping urban areas (Shashamane, Wondo, N/Arsi, Bishoftu, Modjo) were married. However, almost all of the respondents in Batu town were youth groups. Marriage promotes synergy within a farm family and function as a custom to cop up life challenges in the urban community.

**Table 3.** Average percentage (%) of marital status of respondents in the study urban areas.

Marital status	Urban Areas						Over all
	Shashamane	Wondo	N/Arsi	Bishoftu	Modjo	Batu	
Married	86.67	65.00	75.00	73.33	100.0	0.00	66.66

Marital status	Urban Areas						Over all
	Shashamane	Wondo	N/Arsi	Bishoftu	Modjo	Batu	
Unmarried	13.33	35.00	20.00	16.67	0.00	90.00	29.16
Divorced	0.00	0.00	0.00	6.67	0.00	10.00	2.77
Widowed	0.00	0.00	5.00	3.33	0.00	0.00	1.38

### Beekeeping Ownership Type

The beekeeping ownership status of the urban beekeeping respondents was shown in Table 4. The study revealed that the beekeeping ownership category of the respondents is of private, cooperative, and religious type in the present study. Accordingly, in the urban areas, majority (83.3%) of the

beekeepers were reported to have private; some (10%) of the beekeeping activities were religious, and very few (0.5%) of the beekeeping activities were cooperative type. In this study there is no (0%) of the beekeeping type owned by government.

**Table 4.** Beekeeping firm type and land position proportion (%) of respondents in the sample beekeeping urban areas.

Beekeeping form	Beekeeping categories	Urban Areas						Overall
		Shashamane	Wondo	N/Arsi	Bishoftu	Mojdo	Batu	
Beekeeping status	Private	76.70	90.00	90.00	90.00	93.30	60.00	83.30
	Cooperative	3.30	0.00	0.00	10.00	0.00	0.00	0.50
	Government	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	Religious	23.30	10.00	10.00	10.00	6.70	0.00	10.00
	Rental	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Beekeeping land position	Government	0.00	0.00	0.00	0.00	0.00	15.00	2.50
	On the building roof	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	cooperative	3.30	0.00	0.00	0.00	0.00	0.00	0.50
	On the fence wall	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	Back yard	26.70	80.00	80.00	90.00	6.70	0.00	47.20

## 3.2. Beekeeping Experience

Differences in beekeeping experience might be responsible to influence the attitude and adoption of new beekeeping technologies [9]. According to this study, considerable number of (35.85%) urban beekeepers had more than 15 years of beekeeping experience in (Table 5). However, some (23.7%) of the beekeepers had 5 or less experience in beekeeping. This result agrees with

the findings of [8] who reported a considerable proportion (41.1%) of the beekeepers in South Wollo and Wag Himra zones with more than 15 years of experience in beekeeping and [7] of 16.5 years for Sekota district beekeepers. This result was in line with the results of [9]. According to the survey result, as beekeepers acquire the experience, they keep a higher colony number and gain enhanced honey production than the less experienced ones.

**Table 5.** Beekeeping experience of the respondent beekeepers in the current study urban areas.

Beekeeping experience	Proportion of the respondents in urban Areas		
	Frequency	Percent	Mean colony holding
1-5 years	32	23.70	3.79
5-10 years	34	25.19	6.03
10-15 years	26	19.26	4.50
More than 15 years	43	35.85	4.96

### 3.3. Honeybee Colony Holdings

In the present study, the result for honeybee colony holding status of the urban beekeepers was shown in Table 6. The study indicated that while beekeepers in the urban had been keeping bees using traditional (overall mean=0.64) and modern (overall mean =4.05) hives. However, there were no beekeepers found to be practicing transitional beekeeping in the studied urban areas. The average honeybee colony holding of the respondents was found to be 4.05 demonstrating that the study urban areas are suitable for beekeeping development. Accordingly, out of 563 honeybee colonies in the urban

areas, 13.67%, 86.32%, and 0% of the honeybee colonies were set up in traditional, modern, and transitional hives, respectively (Table 6). The honey volume and quality are low for traditional hives [7]. However, beekeepers preferred traditional hives for their less input, low price and operation cost [7], availability (Kebede et al., 2008), convenience to construct, provide more wa, and convenience to be used as a bait hive [10]. The majority (76.30%) of the beekeepers who participated in the study has a colony number below six (Table 6). The result was very comparable with the findings from Kilte Awlalelo, Sekota, and Burie districts which were reported mean number of 5.79, 5.9, and 6.48 colonies per beekeeper, respectively [11].

**Table 6.** Honeybee holding status of the beekeepers in the study area.

Hive type	Bishoftu		Modjo		Batu		Sheshemene		A/Negele		Wondo		Overall total	Overall mean
	Total	Mean	Total	Mean	Total	Mean	Total	Mean	Total	Mean	Total	Mean		
Traditional	13	0.43	15	0.5	9	0.45	16	0.53	10	0.5	14	0.7	77	0.64
Transitional	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Modern	95	3.16	82	2.73	64	3.2	99	3.3	78	3.9	68	3.4	486	4.05

### 3.4. Source of Honeybees

The source of honeybee colonies in the present study was given in table 7. The study indicated that majority (68.3%) of the respondents get their honeybee colonies by catching honeybees swarm followed by purchasing

(8.3%). Some (4.5%) of the respondents get their honeybee colonies as a means of transfer from their family, while very few (1.7%) of them get their honeybee colonies by queen rearing through splitting method. And this agrees with the findings of [8], who reported that 50.3% and 60.3% of the respondents at South Wollo Wag Himra zone and Hadya zone, respectively.

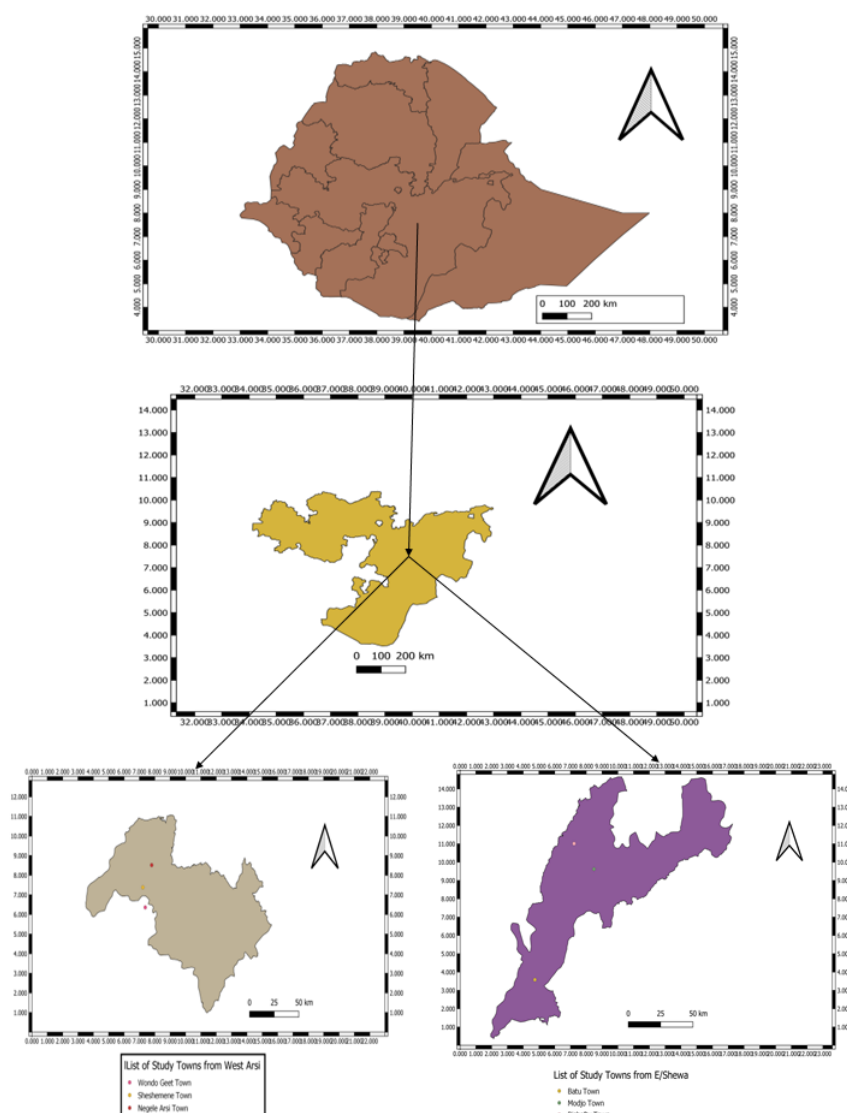
**Table 7.** Average percentage (%) of the respondents by their source of honeybee colonies in the present study urban areas.

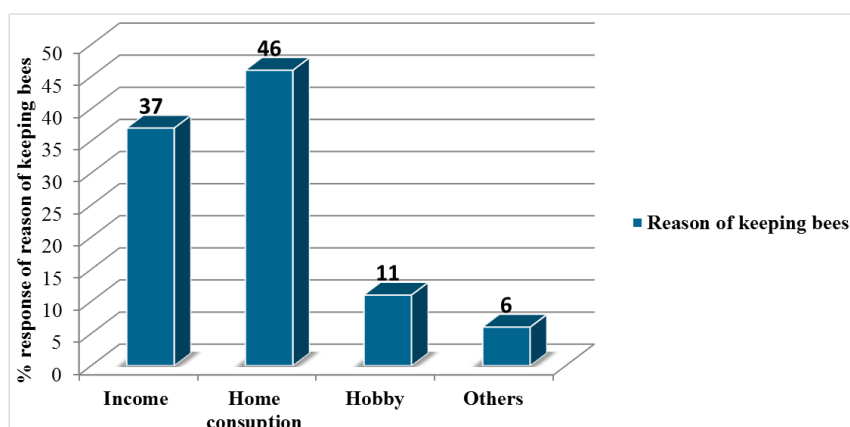
Source of bees	Urban Areas						Overall
	Shashamane	Wondo	N/ Arsi	Bishoftu	Modjo	Batu	
From Parent	6.70	20.00	0.00	0.00	0.00	0.00	4.45
Swarm catch	73.300	70.00	90.00	93.30	83.30	75	68.31
Colony Purchase	13.30	10.00	10.00	6.70	10.00	0.00	8.33
Colony division of	3.30	0.00	0.00	0.00	6.70	0.00	1.66

### 3.5. Reason of Beekeeping

The result of reason of keeping honeybees for urban beekeepers is indicated in Figure 1 below. The study revealed

that majority (46%) of urban beekeepers keep honeybees for home consumption followed by keeping honeybees as source of income (37%) whereas the rest of the respondents keep honeybees as hobby (11%) and for other reasons (6%) like use of honey as medicine.

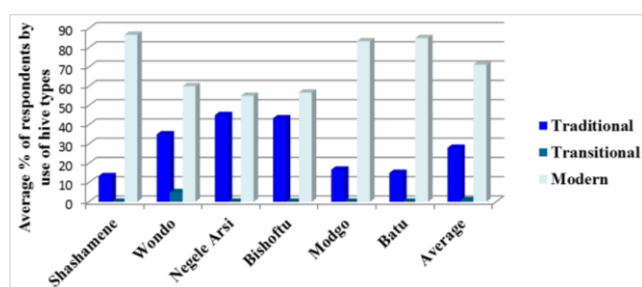
**Figure 1.** Map of the urban areas of the present study.



**Figure 2.** Reason of keeping beekeeping honeybees for the respondents in urban areas.

### 3.6. Beekeeping Practices

The type of beekeeping practiced in the current study urban areas by the respondents is presented in figure 2. As revealed by the study, three distinct types of beekeeping were used by the sample respondents in the study urban areas. In all urban areas average percent (70%) of the respondents practiced modern beekeeping followed by the practice of traditional beekeeping (26%); and the remaining very few (4%) of the respondents practiced transitional beekeeping. The current study is in agreement with [8] who reported traditional, intermediate, and modern beehives are used for honey production in Ethiopia. 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 [9].



**Figure 3.** Type of beekeeping in the study urban areas (%) by sample respondents.

The average annual honey yield per hive from traditional and modern bee hive for Sheshemene, Wondo, Negele Arsi, Bishoftu, Modjo and Batu urban areas is presented in Table 8. The average honey yield from modern beekeeping was significantly higher ( $<0.05$ ) as compared to honey production from traditional hive in all study urban areas. The average annual honey yields per hive from traditional & modern beehive in the current study

were (8.5+0.34 Kg) and (19.6+0.34 Kg) 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.

The variation in average annual honey yield per hive in the hive types (Traditional and Modern) might be attributed to the variation in the suitability and easiness of the technologies for management & follow up for the beekeeper. [8] reported productivity and overall production increases with the level of management, experience and area potentiality. According to the report of CSA (2012) an average of 5-6kg honey/hive/year could be harvested per year in the country which is lower than the current study.

**Table 8.** Mean of Honey yield (kg) from traditional, transitional and movable frame hive in the study area by sample respondents.

Locations	Traditional hive Mean (kg) + SE	Frame hive Mean (kg) + SE
Shashemene	7.4+0.22	19.0+0.73
Wondo	8.7+0.19	20.9+0.83
N/Arsi	9.5+0.16	19.8+0.66
Bishoftu	8.7+0.16	19.8+0.80
Modjo	8.6+0.109	19.9+0.39
Batu	7.9+0.23	18.3+0.85
Overall	8.5+0.34	19.6+0.34

### 3.7. Bee Management Practices

In the study areas, 80.38% of the total colony and 73.88% of traditional colonies are placed at backyards indicating that backyard beekeeping is a common practice of honey production in the study areas, and this agrees with the findings of [9] that establish more proportion of beekeeping at backyards.



Backyards are easier for frequent inspection and other hive managements (including swarm prevention, pest and predator control, and quality honey production) compared with free apiaries [10]. The average percentage of sheltering & placement of beehive of sample respondents in the beekeeping urban areas is presented in Figure 2. The study revealed that the majority average percentage (71.3%) of the beekeep-

ers in the urban areas put their hive on hive stands in their backyard whereas none (0%) of the respondents hung their hive on trees near residential places. Considerable percentage of the respondents (12.2%) kept their beehive on trees away from residential places. The prevailing honey production system in the study urban areas is based predominantly on modern beekeeping technique.

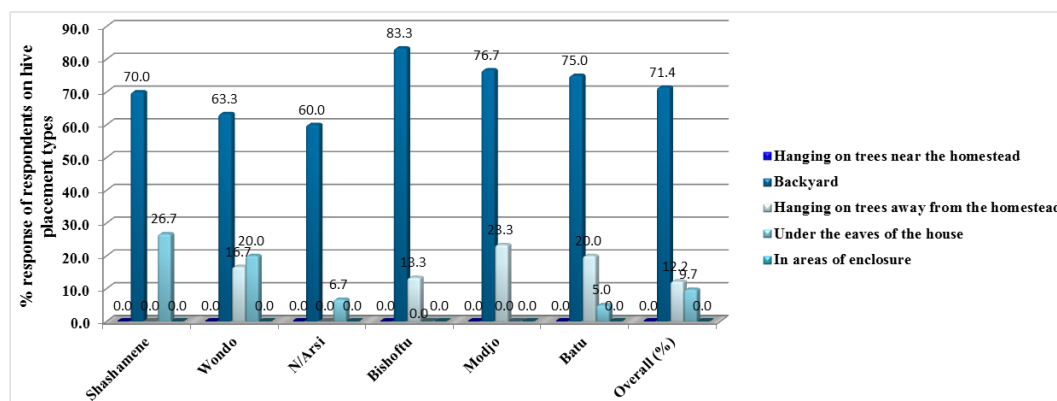


Figure 4. Average percentage (%) of bee hive placement practices of the respondents.

The result of the current study disagreed with [7] 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.

The apiary visit & hive inspection condition of the respondents in the study urban areas is presented in Figure 3. The investigation revealed 77% of the respondents were visited apiary 'some times' 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 [8] who reported the majority of respondents inspect the hive occasionally.

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 [7] who reported 46.7%, 20.6% & 7.5% of the respondents in Bure district conducted internal hive inspection rarely, every month & every fortnight, respectively (figure 3).

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. [10] reported that internal hive inspection of traditional hive is not easy and common due to the inconvenience of the hive design. Similarly, [8] reported that the inappropriateness of traditional hive for internal inspection make the management of reproductive swarming impracticable.

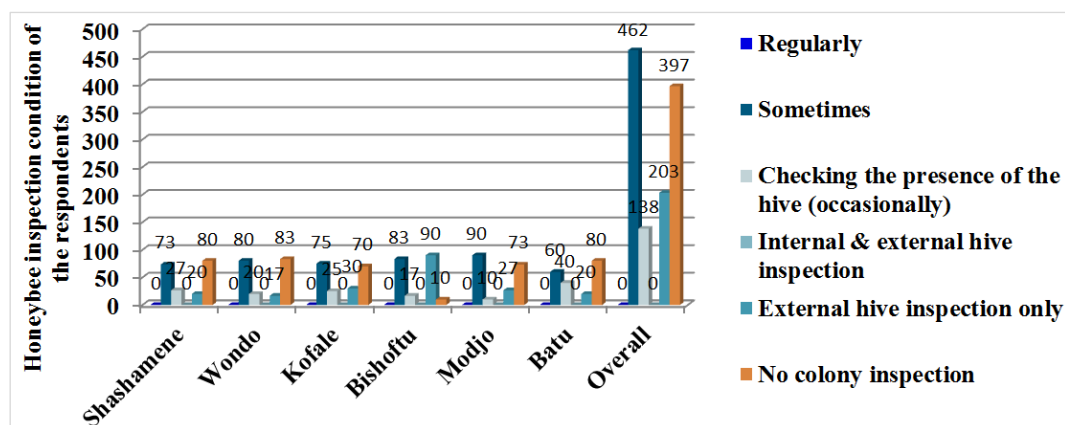


Figure 5. Average percentage (%) of the apiary visit practice of the respondents in sample urban areas.



The management for honeybees is very negligible in the study area. Honey bee colonies sustain themselves naturally and produce honey by foraging from natural and cultivated crops in all possible radiuses from their nests. During the study, it was observed that farmers who have modern bee-hives did not manage it properly. Out of the sampled respondents' only 3.85% practice feeding of their bee colonies, while 96.15% do not practice feeding during dearth periods (Table 9). With regard to the type of feed they provide, of those sample respondents feeding their bees, 1.5% of them use pea flour, barley flour and sugar syrup, 0.8% of them feed only sugar syrup.

**Table 9.** Honeybee feeding condition of the respondents in the study areas.

Description	Response	n	%
Existence of bee feeding	Yes	5	96.15
	No	125	3.85
	Pea flour	2	1.5
	Sugar syrup	1	0.8

Description	Response	n	%
Type of feed	Hot pepper	1	
	Pea flour and sugar syrup	2	1.5
	Honey, Pea flour and sugar syrup	0	
	Sugar syrup and barley flour	1	1.5
	Pea flour, barley flour and hot pepper	0	0

Swarm control is important to minimize the risk of honeybee colony working force loss. Beekeepers in the study areas use different means of bee colony swarm control so that the issued swarm bee colonies remain under their control. Queen cell removal before the queen hatch out (25.8%), reuniting swarm back to mother colony by killing the queen (20.3%), and honey comb harvest (19.4%) (Table 10) are among techniques practiced by the beekeeper to control the swarm. This result agrees with report [11] who established that about, 85.80% of the sample respondents have experience of catching incidental swarms that can be transferred to other hives (70.3%), return to the original hive (34.2%), and offer for selling (4.4%).

**Table 10.** Honeybee swarm control techniques in the study areas.

Parameter	Response	Frequency	Percent	Rank
Method of swarm control	Removal of queen cells	87	66.9	1
	Harvest honey comb	59	45.4	3
	Return back to mother colony	68	52.3	2
	Supering	21	16.2	5
	Use large volume hive	25	19.2	4
	Cut brood combs	6	4.6	6
	Cut old combs	3	2.3	8
	Regular inspection	6	4.6	6
	Attach queen excluder at entrance	2	1.5	9
	Smoking with camel dung	2	1.5	9
	Smoking with mule bone	5	3.8	7
	Smoking with bamboo root	1	0.8	10
	Smoking with Hayginia abissinica flower	1	0.8	10

One of the most important factors to ensure is the extension and training of beekeepers. Extension and training packages are crucial for government sectors to improve technology interven-

tions as well as policy and regulation dissemination. Beekeeping training develops beekeepers' self-confidence in using technology and increases their productivity. According to this study, only

17.8% of beekeepers received beekeeping extension services for improved beekeeping technologies from district development agents. However, the majority of respondents (82.2%) did not receive any beekeeping extension services (Table 11). This result

is in line with the results of [10] who reported that only 33.2% of the sample respondents had the chance of receiving extension service delivery in the Amhara region.

**Table 11.** Average percentage (%) of respondents on the different extension services in the sample study urban areas.

Locations	Parameters			
	Access to beekeeping extension service		Access to beekeeping training	
	Yes (%)	No (%)	Yes (%)	No (%)
Bishoftu	17.78	82.22	38.52	61.48
Modjo	15.2	84.8	0	100
Batu	5.6	94.4	5.6	94.4
Shashamane	0	100	0	100
N/ Arsi	3.8	96.2	3.8	96.2
Wondo	19.4	80.6	19.4	80.6

### 3.8. Common Honeybee Forage Plants of the Urban Lands

The major honey flow season of the current study area is from October to November, the minor flow season is from May to June, and depends upon the availability of bee forage, which in return depends on the amount of rainfall. Based on source status and abundance, 21 plant species were identified by the respondents as important bee flora in the study area. A list of the honey plant species found in the study area is presented in Table 12. According to respondents; Twenty-one plant species were recognized as the major honeybee forage sources. The major bee forage plants identified in the study area are presented in Table 12. Among major plant spp., *Acacia* spp., *Eucalyptus globules*, *Eucalyptus camadulensis*, *Cordia africana*, *Coroton macrostachy*, *Sesbania sesban*, *Cajanus cajan*, *Carissa edulis*, *Entada abyssinica*, *Euphorbia* spp., *Milletia ferruginee*, *Dovyalis abyssinica*, *Rosa abyssinica*, *Echinopes* spp., *Rubus* spp., *Ocimum basilicum*, *Thymus schimperi*, *Trifolium steudneri/acaule*, *Negeta az-*

*urea*, *Thymus schimperi* were identified as natural plants and *Pisum sativum*, *Cicer arietium*, *Solanum tubersum*, *Allium cepa*, *Brassica carinata*, and *Coffea arabica* as cultivated plants that are used as important bee floras of the study district. Apart from these species, honeybees utilize almost all of the identified bee floras as sources of both pollen and nectar. The areas are also known for its horticultural properties. Various horticultural crops as *Allium cepa*, *Citrus sinensis*, *Persea americana*, *Casimiroa edulis*, *Malus domestica*, *pranus persica*, *Psidium*, *guajava*, *carica papaya*, *Lycopersicon esculentum*, *Citrus aurantifolia*, *Mangifera indica*, *Annona senegalensis* and *Musa x paradisiaca* have been grown at the backyard of every homestead for cash and consumption purposes. All of these plants were regularly visited by honeybees, and in the study area, it was also reported that there are some species of plants that flower during long drought periods. Generally, honeybee plants such as *Acacia* spp, *Echinopes* spp., *Jacaranda mimosifolia*, *Coroton macrostachy* and *Rubus* spp. are well known for their dry period flowering and serve as subsistence forage to bees in the study areas.

**Table 12.** Major honeybee forage plant species in the study areas.

No	Scientific name	Common name (in Amharic; fan Oromo)	Agro-ecology	Life	Flowering period (Months)
				Form	
1	<i>Acacia</i> species	Girar (Ajoo)	High/Mid land	Tree	March - July

No	Scientific name	Common name (in Amharic; fan Oromo)	Agro-ecology	Life Form	Flowering period (Months)
2	Acacia saligna	Saligna	Mid /High land	Tree	August -October
3	Brassica carinata	Gomen zer (Danqalee)	Mid/High land	Crop	September-October
4	Cajanus cajan	Yergeb Ater (Atara Guugee)	Mid/High land	Shrub	August-September
5	Carica papaya	Papaya	Mid land	Crop	August -October
6	Coffea arabica	Coffee Buna)	Mid /High land	Crop	March - April
7	Coroton macrostachy	Bisana Makkaniisaa)	Mid land	Tree	March -June
8	Cordia africana	Wanza Waddeessa)	Mid land	Tree	August - November
9	Dovyalis abyssinica	Koshim	Mid /High land	Shrub	March - June
10	Eucalyptus camadulensis	Qeyi barzaf	Mid land	Tree	March -June
11	Eucalyptus globules	Nech barzaf	High land	Tree	March -June
12	Hagenia abysinica	Kosso (Heexoo)	High land	Tree	October to November
13	Jacaranda mimosifolia	yetebemenja zaf (Muka Qawwee)	Mid land	Tree	January - March
14	Mangifera indica	Mango	Mid land	Fruit tree	January-March
15	Millettia ferruginee	Birbera (Birbirsaa)	Mid /High land	Shrub	January- April
16	Ocimum basilicum	Besobila	Mid/High land	Herb	August-December
17	Persea americana	Abokato (Avokaadoo)	Mid land	Fruit tree	January-March
18	Rosa abyssinica	Kega	Mid /High land	Shrub	August - October
19	Rubus spp	Enjori	Mid /High land	Shrub	March - June
20	Sesbania sesban	Sesbania	Mid land	Shrub	August -October
21	Solanum tubersum	Potato	Mid/High land	Crop	May - June

### 3.9. Constraints of Beekeeping

Result in Table 13 shows the major constraints encountered by respondent beekeepers. The table shows that 37.69% of respondents claimed 'Unaffordable cost of inputs' as number one honey production constraint leading to low honey yields. About 23.08% of beekeepers reported 'Lack of appropriate beekeeping knowledge' to be the second most important problem affecting apiculture development, productivity and quality of hive products. Thirdly, 'Absconding of bees' was the other important constraint raised by 16.15% of

respondents. Next, in relative order of importance, was Agrochemicals poisoning and Shortage of bee forages. This study result is in line with [8] who reported shortage of bee forage, agrochemical poisoning and honeybee pest which were also reported as the major beekeeping constraints in Amhara regional state. Similarly, [7] reported that lack of modern beekeeping knowledge, shortage of trained manpower, shortage and cost of beekeeping equipments, less access to credit, pests and predators and inadequate research works to support development programs of the sector as problems of low production in bee keeping sub sector in his study district of Atsebi Wemberta district of Ethiopia.

**Table 13.** Major beekeeping constraints in the study areas.

No	Constraints	Frequency	%	rank
1	Agrochemicals poisoning	16	12.31	4
2	Unaffordable cost of inputs	49	37.69	1

No	Constraints	Frequency	%	rank
3	Shortage of bee forages	14	10.77	5
4	Absconding of bees	21	16.15	3
5	Lack of appropriate beekeeping knowledge	30	23.08	2
	Total	130	100	

The result of available honeybee pests and predators was described in Figure 6. According the urban beekeepers the common honeybee pests and predators were reported to be Ants, Lizards, Spiders, Monkeys, Wax Moths and Beetles in their order of importance.

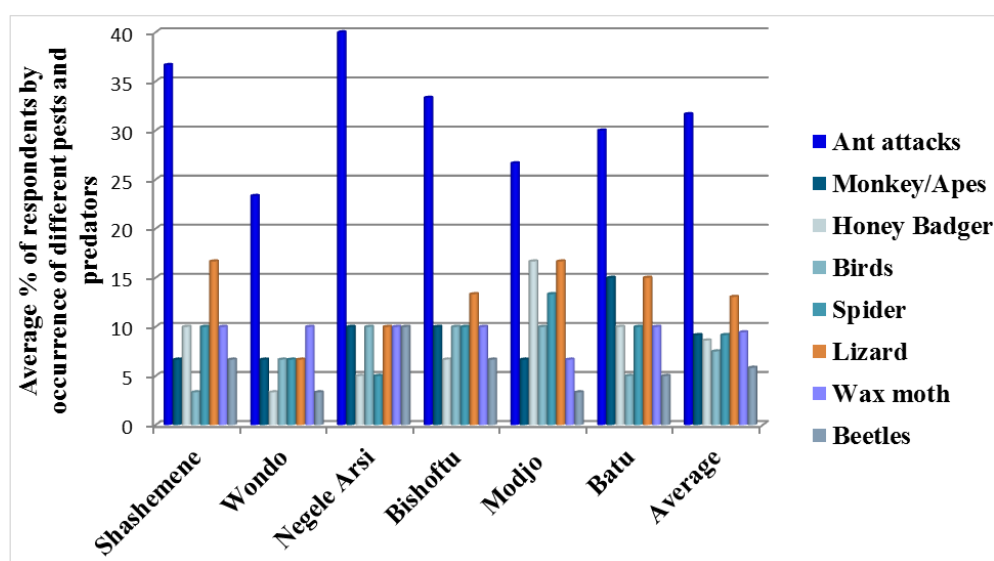


Figure 6. Proportion (%) of respondents on honeybee pests and predators in the sample urban areas.

During study period, several techniques were stated by sample respondents to control pests and predators in the study locations. When they were asked how to control pests and predators in your area, the respondents were mentioned using ash around hives stands for the most common pests, attaching smooth iron sheets to the trunks of trees where hives are hanging, hanging hives on long trees with very

smooth bark so that honey badgers cannot climb them, using dogs for back yard, and killing honey badgers by using *wot-med* (Table 14). Different researchers have reported that beekeepers in different part of the country were used several defense strategies to keep their honeybees safe from pests and predators [10].

Table 14. Traditional practices of controlling major honeybee pests and predators by beekeepers.

Pests and predators	Traditional controlling mechanisms /practices
Honey badger	Use of dog for chasing, use of "wotmed" to kill, fencing the apiary site with strong fence, hanging hives by rope on long trees
Spiders	Cleaning apiary site always, removing the spider webs, putting ash under the hive stand
Ants	Applying ash under hive stand, cleaning apiary site
Wax moth	Supply supplementary feeding and water to the colonies to be strong, fumigating the hive, removing the old comb from hives, and cleaning beehives

Pests and predators	Traditional controlling mechanisms /practices
Birds	Frightening birds from the area, putting like tallow, mastic, and plastic on hive entrance, placing wheat seed or barely, putting an image of a human near the hives using cloth
Small hive beetles	strengthening the colony or keeping strong colonies, removing weak colonies, cleaning apiary, smoking/fumigating the hive
Monkey	Hanging beehives on a branch of long trees by ropes, keeping beehives near home steady
Bee lice	Fumigate the hive with materials like tobacco, dung and grass, making colonies strong, supplying additional food for weak colonies

### 3.10. Opportunities of Keeping Bees in Urban Areas

There are many opportunities that encourage beekeepers to start and promote beekeeping practice in urban areas (Table 15). Absence of honeybee pests (74.6%); Absence of agrochemicals (70.8); Availability of bee forages (70%); Availability of bee colonies (68.5%); and availability of clean water (66.2%) and Access to market (64.6%) in urban areas is the major to mention. This is similar with the findings of [11] in Afar region, who reported that the presence of large number of bee floral species, high demand of hive products and presence of favorable environment with various agro-ecology were the most listed opportunities. [11] in

Hadiya zone possess similar opportunities, such as availability of many numbers of local hive and suitability of environment with different agro ecology, willingness of farmer to improve beekeeping practice and currently high market demand of bee products. Availability of eager beekeepers to accept new technology, existence of strong bee colonies, availability of adequate apiculture flora and water resource, market access and infrastructure were also good opportunities in Gedeo zone [10]. In addition, [10] reviewed that abundant bee forage availability with favorable and diversified agro-climatic conditions in Ethiopia were good opportunities for beekeeping medicinal values of honey, identification of important honeybee floras and identification of adulterated honey.

**Table 15.** Major beekeeping opportunities of the study areas.

No	Beekeeping opportunities	Frequency	%	rank
1	Availability of bee forage	91	70	3
2	Availability of clean water	86	66.2	5
3	Absence of agrochemicals	92	70.8	2
4	Access to market	84	64.6	6
5	Availability of bee colonies	89	68.5	4
6	Absence honeybee pests	97	74.6	1

## 4. Conclusion and Recommendation

Beekeeping has been widely in practice in the present study urban areas. Major beekeeping forms in the areas were modern beekeeping followed by traditional one. The overall

average of honeybee colony ownership of the respondents was substantially higher. Moreover, the overall mean of honey produce in the present urban areas was found to be considerable. Majority of the respondents get their honeybee colonies by catching honeybee's swarm. Two types of beekeeping i.e traditional and modern beekeeping practices were

in place in the present urban areas. The average honey yield from modern beekeeping was significantly higher as compared to honey production from traditional hive in the present urban areas. According to this study, only few of the beekeepers received beekeeping extension service and training on use of improved beekeeping practices, while the majority of the respondents did not get any beekeeping extension service.

Based on the findings, the following recommendations are forwarded: Immense emphasis should be given to strengthen the extension services & technical intervention in the urban beekeeping to enhance development of improved beekeeping that can significantly increase the quantity & quality of honey yield. Provision of ways of getting improved beekeeping technologies with affordable price to the beekeepers in the area can promote improved beekeeping practices in urban lands Development and implementation of city beekeeping rules and regulations that are best fit for city beekeeping activities are of paramount importance.

## Conflicts of Interest

Authors declare that there is not any conflict of interest.

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