Journal of Entomology and Zoology Studies

Available online at www.entomoljournal.com

E-ISSN: 2320-7078
P-ISSN: 2349-6800
JEZS 2018; 6(2): 2408-2414

Received: 07-01-2018
Accepted: 09-02-2018

Mulualem Ambaw
Ethiopian Institute of Agricultural Research, Kulumsa Agricultural Research Center, P.O. Box 489, Assela, Oromia, Ethiopia

Teklemedhn Teklehaimanot
Ethiopian Institute of Agricultural Research, Kulumsa Agricultural Research Center, P.O. Box 489, Assela, Oromia, Ethiopia

Correspondence
Mulualem Ambaw
Ethiopian Institute of Agricultural Research, Kulumsa Agricultural Research Center, P.O. Box 489, Assela, Oromia, Ethiopia

Characterization of beekeeping production and marketing system and major constraints, in selected districts of Arsi and West Arsi zones of Oromia region in Ethiopia

Mulualem Ambaw and Teklemedhn Teklehaimanot

Abstract
This study was conducted in selected district of Arsi and West Arsi Zones in Oromia Region. A total of seven districts were selected purposively. 204 beekeepers were interviewed by using structured questionnaire. The average age and beekeeping experience of the respondents were 42 and 26.5 years respectively, which beekeeping is one of the agricultural practices for a longer period of time in the study districts. Men beekeepers take the larger share (99%) to be involved in beekeeping activities than women. The majority of beekeepers 84% were educated from primary to tertiary level. Different bee forage species were identified by the respondents in local name as trees, shrubs and herbs. The major constraints of beekeeping in the study areas were ranked as chemical poisoning, pests and predators and finally luck of beekeeping knowledge. In conclusion, the existing beekeeping practice of the study districts were low input output system interwoven by many constraints.

Keywords: honey production, marketing, beekeeping constraints Arsi and West Arsi zone

1. Introduction
There is an ancient tradition of beekeeping in Ethiopia that stretches back into the millennia of the country's early history. Although difficult to establish a time reference when beekeeping was started in Ethiopia, it may date 5000 years back and the Hieroglyphs of ancient Egypt refers to Abyssinia (the former name of Ethiopia) as the source of honey and beeswax. Thus Abyssinia has been known for its beeswax export for centuries during when other items were not exportable [1].

Ethiopia is the first African countries with huge honey and beeswax producer and having rich plant biodiversity for bee forage. The ideal climatic conditions and diversity of floral resources allow the country to sustain around10 million honeybee colonies, of which 7 million are kept in local beehives by farmers and the remaining, exist in the forests as wild colonies [2, 3]. Ethiopia produces about 43,373 metric tons of crude honey per year, thus shares 23.5% of Africa and 2.35% of world's honey production. This makes the country rank 1st in Africa and 10th in the world [4, 5]. Currently, more than 7000 species of flowering plants are estimated to be found in the country, of which more than 800 of them are honeybee plants [4,6].

Despite the long tradition of beekeeping in Ethiopia, having the highest bee density and being the leading honey producer as well as one of the largest beeswax exporting countries in Africa, the share of the sub-sector in the GDP has never been commensurate with the huge numbers of honeybee colonies and the country's potentiality for beekeeping. Productivity has always been low, leading to low utilization of hive products domestically, and relatively low export earnings. Thus, the beekeepers in particular and the country in general are not benefiting from the sub sector [7] because; most of the beekeeping practice is traditional type.

Beekeeping is also a very long-standing practice in the farming communities of the Oromia region and it plays a significant role as a source of additional cash income and nutrition for many subsistence farmer beekeepers. It is an integral part of the smallholder farming system. The natural vegetation coverage is relatively high, as a result in this area the honeybee population is dense and production is relatively high. Besides, the beekeeping potentiality of the region, it is partly attributed to the various cultivated oil crops, pulse and field flowers, which are very important, source of forage. In Arsi and West Arsi zones of Oromia region large proportion of inaccessible lands for agriculture are covered with various types of trees,

shrubs, bushes, and field flowers that make the Zones still potential for beekeeping. However, it requires making efforts to address some of the major problems of beekeeping and to keep it productive in the sustainable way

Recently, different beekeeping development endeavors have been made by the governmental and non-governmental organizations in the Oromia region. The region having large share of honey production of the country, with about 41% of total country's production, the regional government disseminated considerable number of modern (box) hives to farmers which are produced by different regional agricultural mechanization, research centers and different private microenterprises in 2001/02. Arsi and Weast Arsi Zones are the potential Zones of the region for honey and bees wax production where modern beehives distributed on cash and credit basis from Arsi Agricultural Mechanized Research Center and private microenterprises [8]. In addition to distribution and dissemination of improved beekeeping technologies Production and marketing system characterization is important to identify problems and come up with research proposals relevant to the problems and to formulate appropriate research and development plan. Hence, characterization of production system, identifying and prioritizing the available constraints and suggesting possible interventions areas, are the first steps towards any development planning in any fields and also in the apiculture sub-sector. So far in districts of Arsi and West Arsi Zones; there is no compiled and reliable information on honey production and marketing system. Therefore, this study was conducted to characterize the beekeeping production and marketing system and to identify major constraints of beekeeping in Arsi and West Arsi Zones

2. Materials and Methods

2.1 Study areas and data collection

This study was conducted in selected districts of Arsi and West Arsi zones. Multistage purposive sampling methods were employed. Seven districts from the two zones were selected purposively based on agro ecology, road accessibility and beekeeping potentiality. A total of 204 beekeeper farmers who possess at least one bee colony were selected randomly and interviewed with pre-tested questionnaire. Data like Socio demographic characteristics (sex, age, family size, land holding, beekeeping experience, educational level amount of honey produced in different types of hives, hive types, honey processing and storage practice, number of bee colonies owned by each beekeeper farmers, available bee forage in the study areas, prevention and control of swarming, post harvest management, honey flow season in the study areas, marketing condition of beekeeping inputs and out puts, information flow, availability of credit for beekeeping, bee poisoning plants and agrochemicals chemicals, types of pest and predators of honey bees encountered in the study areas were collected by interview of the farmer beekeepers. In addition, major constraints for honey bee production in the study areas were also collected.

3. Data analysis

The data was analyzed using the Statistical Packages for Social Sciences (SPSS) version 16.0. Descriptive statistics was used for the qualitative data; while analysis of variance was employed for quantitative data. Means were separated using least square significant difference whenever they were statistically significant at $P<0.05$

4. Result and discussion

4.1 Socio demographic characteristics of the respondents

The average age of the respondents was 42 years (ranging from 20-90 years).Beekeeping activity is practiced for long period of time in the study areas with an average of 26.5 years. From 204 beekeeper farmers interviewed 99% 202(204) were male headed and the remaining two were female headed. Eventhogh, all household members participate in beekeeping activity, men and women were involved in most of the beekeeping activities than children. The men alone play the major roles 37.3% of the beekeeping activities (see table1 and 2).The result is similar with [9], in Kaffa,Sheka and Bench-Maji zones of Ethiopia whom the majority of the beekeeping activities were practiced by men alon. Regarding livestock holding beekeeper farmers have cattle, sheep, goat, equines and, chicken together with bees. The minimum, maximum and mean animal holding of the beekeeper farmers other than bee colonies were described under (table 3).In all sampled districts most of beekeepers were relatively old age. Regarding the level of education; 16% of the interviewed beekeepers did not receive either formal or none formal education. The remaining 84% of the respondents were at different stage of education level from primary to high school complete fig 1. The farmer beekeeper education level is one of the determining factors for the expansion of the beekeeping technology. Most of the beekeepers were educated since the transition of traditional beekeeping to the modern beekeeping practice needs in more skills and knowledge in Ethiopia. This study finding is in agreement with chala *et al.* [10], the majority of the interviewed households in Gomma District, South Western Ethiopia were educated.

Table 1: Socio demographic characteristics of the beekeeper farmers in the study areas (n=204)

Sociodemographic data	Min	Max	Mean	SD
Beekeeping Experience(years)	1	52	26.5	10.25
Age of house holed	20	90	42.31	12.96
Family size	1	25	8.61	4.46
Land holding	0	14	2.46	2.00

N= number of respondents, SD=standard deviation

Table 2: Members of the house hold involvement in bee keeping activities

No	Gender role in beekeeping activity	Number of household	percent
1	Men	76	37.3
2	Children	1	0.5
3	Men and women	83	40.7
4	Men, women and children	35	17.2
5	Men and children	9	4.4
6	Total	204	100

Table 3: Livestock holding of farmer beekeepers in the study areas

No of animals other than bees	N	Minimum	Maximum	Mean
Number of cattle owned	204	0	70	9.87
Number of sheep owned	204	0	120	8.96
Number of goat owned	204	0	20	.86
Number of equines	204	0	15	2.46
Number of chicken owned	203	0	50	5.83
No of bee colony	204	1	120	8.08

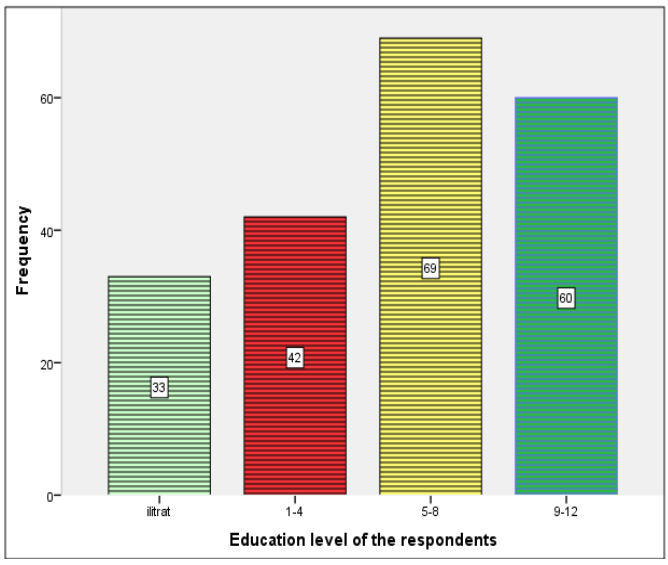

Fig 1: Education level of respondents in the study area

4.2 honey bee colony distribution and types of beehives owned,

In total 2644 bee hives with honey bee colonies from which 64% traditional, l9.3% box, 18.6% both traditional and box hive (see the table 4 below) were reported. The result agrees with Serda *et al*. [11], the majority of the beekeeper farmers have traditional types of beekeeping in Haramaya District, Eastern Ethiopia. The mean colony holding in the study areas were 8 with minimum and maximum of 1 and 120 respectively. About 77% of respondents have got their bee colonies by catching swarms (putting smoked hives on branches of trees while 23% of them got bee colonies by catching swarm clusters, buying and gift from parents. This result is similar to the reports of [12, 10, 13]. majority of beekeepers initiated beekeeping through swarm catching in Gedeo zone, southern nation, nationalities and peoples regional state, Ethiopia**,** Burie district of Amhara region and Gomma district in Oromia Region, respectively. The highest colony population 373 was recorded from Kofele where us the honey production per year was high 1226 kg in Sagure.the honey bee colony and amount of honey produced per year is described in (table5) below. The possible reason could be because of the difference in agro ecology. Kofele is extreme highland which is not favorable for bees to practice the routine activity and produce honey; rather they hibernate in the hive for the long period of time.

Table 4: Types of bee hive used in the study areas

Hive types	Frequency	Percent (%)
Traditional	131	64.2
Box hive	19	9.3
traditional and transitional	2	1.0
traditional and transitional and box	8	3.9
Traditional and box hive	38	18.6
Transitional and box hive	6	2.9
	204	100

Table 5: Honey bee population, honey production in kilogram/year honeybees by Districts in Arsi and West Arsi zone of Oromia region

Zones	Respondents Districts	Total Number of bee colonies	Total honey production, kg /year
Arsi	Digelutijo (Sagure)	180	1226
	Limubilbil (Bekoji)	354	348
	Tiyo	170	771
	Arsi Robei	174	490
	Lodetosa (huruta)	111	582
West Arsi	Kofele	373	929
	Dodola	279	418
Total		2644	4764

4.3 Common honey harvesting seasons in the study area

In all the study areas two honey harvesting seasons were indicated. Major honey harvesting season was from September to November, October to December. Exceptionally the major honey harvesting season for Kofele District were May to June and the minor honey harvesting season were October to December (table 6).Similar research result was reported by different authors [16, 14]. This variation among the different districts could be due to availability of different flowering plants in different seasons and agro climatic conditions. Regarding the minor honey harvesting seasons of the study districts, May to June and December to Novemember which is different from the other research reports of [6, 14]. There is variation of honey harvesting season among different districts because of agro ecology.

Table 6: The common honey harvesting seasons in the study areas

Honey harvesting seasons/	Respondents residence district						
	Digelutijo (Sagure	Limubilbil (Bekoji)	Tiyo	Robei	Lodetosa	Kofele	Dodola
Majorharvesting season	Sept-Nov	Sept-Nov	Sept-Nov	Oct-Dec	Oct-Dec	May-Jun	Oct-Dec
(Minor honey harvesting season	May-Jun	May-Jun	May-Jun	May-Jun	May-June	Dec-Nov	May-Jun

4.4 Major honey bee forages (plants)

Flowering plants are important for honey production and sustain the life of bees. In the study areas fifty seven important flowering plants in the study area have been presented in local and scientific names with their respective life forms (table7). According to the results of the survey, honey bee plants of the study area composed of trees, shrubs, herbs, grasses and cultivated crops. The result is similar to the previous research report [15]. The majority of bee forage in the study area was trees followed by herbs. Most of the flowering plants mentioned by the respondents were both pollen and nectar sources.

Table 7: Major bee floras in the study areas according survey result

Local name	Scientific name	Life forms	Source
Grawa (Ebicha)	*Vernonia* species	Shrub	N/P
Mekanisa (Bisana tremanturi)	*Croton macrostachys*	Tree	N/P
Bahirzaf (bargemo)	Eucalyptus spp	Tree	N/P
Koshim	*Dovyalis abyssinica*	Shrub	N/P
Acacia (lafto) grar	*Acacia spp*	Tree	N/P
Kulkual (adami)	*Euphorbia candelabrum*	Shrub	N/P
Wanza (wodesa)	*Cordia Africana*	Tree	N/P
Buna	*Coffee spp*	Shrub(crop)	N/P
Hada (mech)	*Bidens pachyloma*	Herb	N/P
Gesho	*Rhamnus prinoides L.*	Shrub(crop)	N/P
Ejersa (Wira)	*Olea europeae*	Tree	N/P
Gomen	*Brassica spp*	Herb(crop)	N/P
Dnch(potato)	*Solanum tuberosum L*	Herb(crop)	N/P
Bakela	*Vicia faba*	Herb(puls crop)	N/P
Bekolo	*Zea mays*	herb(crop)	P
Nim	*Azadirachta indica*	Tree	N/P
Serdo sar	*Cynadon doctylon*	Herb(grass)	N/P
Wanza	*Cordia Africana*	Tree	N/P
Warka	*Ficus vasta*	Tree	N/P
Besobla	Ocimum basilicum	Shrub	N/P
Indod	*Fitolaca dodokandra*	Shrub	N/P
Amagto(	*Tryfolium spp*	Herb	N/P
Sespania	*Saspania saspan*	Sh rub	N/P
Sokoro(awtawt)	*Acanathaceae*	Shrub	N
Sensel(SMIZA)	*Justitia*	Shrub	N/P
Ababo	*Amarntecea=celocia arjentea*	Herb	N/P
Debo(dmblal)	*Coriandrum sativum*	Herb	N/P
Agam(Agamsa)	*Carissa edulis*	Herb	N/P
Adda/Tufo	*Ageratum Conyzoides*	Herb	N/P
Adey- Abeba(Kelo)	*Bidens Macroptera*	Herb	N/P
Kosheshila	*Carduus Camaecephalus*	Herb	N
Suf (Sufi)	*Carthamus tinctorius*	Herb(oil crop)	N/P
Sekoru (oro)	*Echinops longisetus*	Herb	N/P
Nug (Nugi)	*Guizotia abyssinica*	Herb(oil crop)	N/P
Mech (Hade)	*Guizotia scabra*	Herb	N/P
Yeferenji Suf (Nugi adi)	*Helianthus annunus*	Herb(oil crop)	N/P
Hareg	*Microglossa pyrifolia*	Herb	P
Basobila ((Sokoksa)	*Saliva nilotica*	Herb	N/P
Tosign	*Thymus schimperi Roninger*	Shrub	N/P
Shoala(HARBU)	*Ficus sure*	Tree	N
Kosso(heto)	*Hyginia abisinica*	Tree	N/P
Kombolcha(ATAT)	*Maytenuse obscure*	Tree	N/P
Geteme(harfetu)	*Shefflera abisinica*	Tree	N/P
Loll(sombo)	*Ecuberjia capensis*	Tree	N/P
Zenmbaba(meti)	*Phoenixriclinata*	Tree	N/P
Kulkuala(kulkual)beles	*Opuntica ficus indica*	Shrub	N/P
Dendesa(abalo)	*Combretum molle*	Tree	N/P
Asta(sato)	*Erica arboria*	Tree	N/P
Bsana(bekenissa)	*Croton macrostachys*	Tree	N/P
Kulkual(hadami)	*Euphorbia spp*	Shrub	N/P
Gulo	*Ricinus cominus*	Shrub	N/P
Ameja(geremba)	*Hypericum rivolutum*	Shrub	N/P
Tkurenchet (muka raja)	*Pruness Africana*	Tree	N/P
Kazameron	*Kasmiroa edulis*	Tree	N/P
Danisa(wulkfa)	*Dombeya torrid*	Tree	N/P

P=Polen
N=nectar

4.5 Pests and predators of honey bee in the study area

According to the beekeeper farmers perception and experience pests and predators were the major cause of colony absconding in the study areas. The frequencies of occurrences of pests and predators in different areas were varied. Most frequently and widely distributed Pests and predators were: ants, spiders, hamagotas wax moth, lizareds, bee lice, birds, and spiders etc--[16]. The other predators and pests which are not as such important were, Apes, Monkeys, Snakes and hive beetles. Even though, there are no appropriate prevention and control methods for honey bee pests and enemies in the country in general and in the study areas in particular, some beekeepers put ashes and burned oil around hives to protect ants,dogs to prevent hamagota and cleaning spider nets around hives. Beekeepers perceived no prevention and control practices at all for bee-eater birds,

beelice, and wax mouth in the study areas. The major enemies and pests of honey bees in the study areas are listed under in the (table 8) below.

Table 8: Major enemies and pests of honey bees in different study districts

Pests and predators/area	Digelutijo	Limubilbili	Tiyo	Robei	Lodetosa	Kofele	Dodola	Total	rank
Spider	16	16	25	15	28	29	21	150	1st
Birds	13	20	20	23	29	15	15	135	2nd
Hamagota	7	14	25	16	23	25	18	128	3rd
Ant	13	13	25	9	29	19	10	118	4th
Wax mouth	15	11	0	10	10	0	1	47	6th
Lizards	11	4	13	6	26	12	7	79	5th
Bee lice	6	11	4	1	8	5	3	38	7th
Hive beetle	0	0	0	0	2	2	1	5	8th
Apes	0	0	2	0	0	0	0	2	10th
Snake	0	0	1	0	2	0	0	3	9th
Rank									
1st	Spider	Birds	Spider, hama & ant	Bird	Bird,waxmoth	Spider	Spider		
2nd	Waxmoth	Spider	Bird	Hama	spider	Hama	Hama		
3rd	Birds &ants	Hamagota	Lizared	Spider	lizared	Ant	Bird		

4.6 Post harvest management and marketing of honey in the study areas

Honey processing and marketing is common practice in the study areas. The majority 50.5 % of the beekeeper farmers use Cloths, selection of honey by hand, honey extractor, 7.8%, 1.5%, 18.1%, 14.7% and the combination of sieve and honey extractor 8.4% respectively. The remaining 49.5% of the respondents did not process the honey mainly due to lack of processing equipment, lack of skills for processing and local consumer's preference to crude honey.

In this study, different honey marketing participants were identified. Honey marketing participants in the study area includes producers/farmers, honey collectors/assemblers, retailers and final consumers of the product. Producers/farmers sell their honey to different buyers at the village or district market center. The market place that is the closest to the residence of the farmers is the first choice with regard to minimization of transportation. The majority (79%) of beekeeper farmers were soled 10-100 % of the harvested honey. on average 55% of the harvested honey were sold and the remaining 45 % used for home consumption. Some beekeepers 4.4%, 2%,1.5% and1 % of them sold their honey to beekeepers co-operatives, middle merchants, wholesalers and local brewers, respectively, where as 34.3% of them sold their honey at farm gate for local consumers mainly for wedding ceremony and sometimes for medical purposes and 35.2% of the respondents soled for local consumers, local brewers and merchants. The price of honey in the study area varies from 50 to 80 ETH birr per kg of honey and average price of 30 birr. Almost all beekeeper farmers have at least one market center where to buy or sale their honey. Near by market and homes were major sale places of honey in the study areas. The price of honey subjected to fluctuation with highest price in the dry seasons especially during wedding time (January to April) and also during wet seasons (June to August) in the period when there was no honey production and lowest price during honey harvesting times (September to November and May).They use honey as food, drinks, medicine and for income generation. Almost all interviewed beekeepers did not harvest beeswax because of lack of awareness about the product, lack of processing skill, lack of beeswax processing materials, and lack of beeswax market. As a result no one has benefited from the product except using it for oiling of local food baking materials and fumigation of hives.

Honey were stored and transported to the market by Plastic containers, earthen pot, tin, animal skin and gourd which were the major honey storage containers in the study areas after harvesting from which 61.8% of the respondents use plastic containers, 26.5% earthen pot,4.9% tin, animal skin 4% and the combination of different containers (figure2). Producers stored honey for one to six months except some who stored more than this for home consumptions. There were dryness and bad taste of honey stored in earthen pots and tin respectively, because of moisture absorption nature of earthen pot and rest formation in tin containers. They use fire, sun light and boiled water bath to change dry honey into liquid honey. From the above figure most of the respondents use plastic container which is a recommended storage material for honey (table 9).

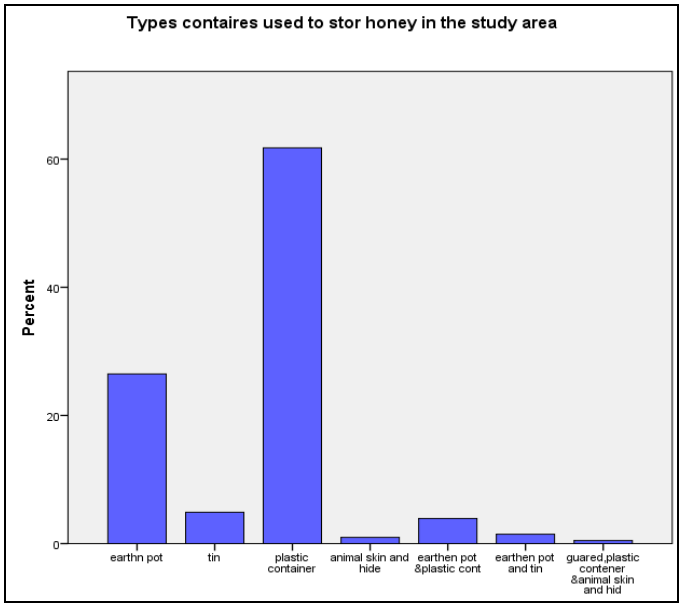

Fig 2: Types of containers used in the study areas to store and transport honey

Table 9: Length of storing of honey in the study areas

Length of storage	Frequency	Percent (%)
No storing	81	39.7
Storing from One to six months	85	41.7
Storing from one to two years	36	17.6
Storing more than two years	2	1.0
Total	204	100

4.7 Access to training on beekeeping

Access to beekeeping training:-72% of respondents couldn't get any training on beekeeping practice in the study areas. The remaining 28 % of the respondents have got training by both NGOS and government organizations on hive and honey management and honey processing. Lack of knowledge in all aspects was one of the gaps in the study areas for beekeeping practices in combination with lack of other beekeeping inputs. Poor access to beekeeping training and technical support causes great difficulties for any beekeepers that adopt modern beekeeping equipment. Because it renders the beekeepers to follow traditional management approaches while using modern hives and fails to reap full benefits from their investment [17].

4.8 Major constraints of beekeeping production system in the study area

Beekeepers interviewed to rank constraints of beekeeping practice accordingly his priority from (1-10) to identify the most important constraint that hinder the development of beekeeping in the study district. Based on beekeepers response most common and major problems were lack of modern hive, accessories,(bee veil, smoker, hand glove), absconding, poisoning of bees by agrochemicals, lack of appropriate honey processing materials, limited beekeeping training for farmers and experts, pests and predators, shortage of bee food, death of colony and drought (lack of rainfall)were ranked below in (Table 10).

The major problems of beekeeping in the study areas were ranked in the table below. pesticide and herbicide application is the first priority and pests and predators as the second major problem of honey production from which ants, honey badgers, birds and small hive beetles which may account for 20% of the total honey production loss annually. Similarly, many researchers found that ants attack is the most serious problem in beekeeping sector [18, 19]. The result also supported by a study of [16], which reported that bee pests, predators and absconding are major constraints affecting honey sub-sector in northern Ethiopia

Table 10: Major constraints of beekeeping in the study areas given ranks 2014/2015) (N= 204)

Major constraints	No respondents	%	Rank
lack of standard bee hive	84	41.2	5th
lack of beekeeping materials	134	65.7	4th
lack of honey bee colony	23	11.3	9th
shortage of bee forage	77	37.7	6th
Drought	32	15.7	8th
Absconding	48	23.5	7th
pest and predators	177	86.8	2nd
Honey bee disease	13	6.4	10th
pesticides and herbicides application	193	94.6	1st
shortage of knowledge in bee management	167	81.9	3rd

5. Conclusions

In conclusion the existing beekeeping practices of the study districts were more or less in a traditional manner and less productive interwoven by many constraints. Application of agro chemicals and pesticides were the major discouraging factors for beekeeper farmers' coupled with pests and predators. Despite the above constraints and challenges there are enormous opportunities and potentials to bust production and productivity of honey and beeswax in the study areas through introducing affordable and appropriate beekeeping technologies with all accessories and strengthening the appropriate beekeeping management practices, and finally mobilizing women and non beekeepers in to sub-sectors through training. Policy intervention on the application of pesticides and agrochemicals should be in place to exploit its potential.

6. Acknowledgments

Ethiopian Institute of Agricultural Research, Kulumsa Agricultural Research Center is acknowledged for their financial support. Agricultural experts in Arsi and West Arsi zone and beekeeper farmers also acknowledged for their cooperation during data collection.

7. Competing Interest

The authors declared that no any computing interest regarding this manuscript.

8. References

1. Gezahegne Tadesse. Marketing of honey and beeswax in Ethiopia: past, present and perspective features: Proceedings of the third National Annual Conference of the Ethiopian Beekeepers Association (EBA), September 3-4, 2001, Addis Ababa, Ethiopia, 2001b, 78-88.
2. CSA. Statistical Abstracts. Central Statistical Agency. Addis Ababa, Ethiopia, 2009.
3. MoARD. Livestock Development Master Plan Study. Phase I Report - Data Collection and
4. Analysis, Volume N - Apiculture. Addis Ababa, Ethiopia, Ministry of Agriculture and Rural Development, 2007.
5. Kebede Nigussie, Subramanian PA, Gebrekidan Mebrahtu. Physicochemical Analysis of Tigray Honey: An Attempt to Determine Major Quality Markers of Honey. Bulletin of the Chemical Society of Ethiopia, Addis Ababa, Ethiopia, 2011, 26(1). https:// www. ajol.info/index. php/ bcse/ article /view/72967
6. Workneh Abebe, Ranjitha P. Beekeeping Subsector Challenges and Constraints in Atsbi Wemberta District of Eastern Zone, Tigray Region, Ethiopia. Journal of Agricultural Extension and Rural Development. 2011; 3(1):Z8–12. https://cgspace.cgiar.org /handle/ 10568/3233
7. Gidey Y, Mekonen T. Participatory Technology and Constraints Assessment to Improve the Livelihood of Beekeepers in Tigray Region, northern Ethiopia. CNCS Mekelle University. 2010; 2(1):76-92 https://www.ajol.info/index.php/mejs/article/view/49654.
8. Nuru Adgaba. Geographical races of the Honeybees (*Apis mellifera* L.) of the Northern Regions of Ethiopia. Ph.D dissertation. Rhodes University, South Africa, 2002.
9. Tamrat Gebiso. Adoption of Modern Bee Hive in Arsi Zone of Oromia Region: Determinants and Financial Benefits, Agricultural Sciences. 2015; (6):382-396. http://www.scirp.org/journal/as http://dx.doi.org/10.4236/as.2015.63038.
10. Awraris Getachew Shenkute, Yemisrach Getachew, Dejen Assefa, Nuru Adgaba, Gebeyehu Ganga, Workneh Abebe. Honey production systems (*Apis mellifera* L.) in Kaffa, Sheka and Bench-Maji zones of Ethiopia. Journal of Agricultural Extension and Rural Developmen. 2012; 4(19)528-541. http:// academicjournals.org/JAERD,DOI: 10.5897 /JAERD12.088.
11. Chala Kinati, Taye Tolemariam, Kebede Debele.

Assessment of Honey Production and Marketing System in Gomma District, South Western Ethiopia, Greener Journal of Business and Management Studies. 2013; 3(3):099-107. www.gjournals.org
12. Serda B, Zewudu T, Dereje M, Aman M. Beekeeping Practices, Production Potential and Challenges of Bee Keeping among Beekeepers in Haramaya District, Eastern Ethiopia. Journal of Veterinary Science and Technology. 2015; 6:255. doi:10.4172/2157-7579.1000255.
13. Teklu Gebretsadik, Dinku Negash. Honeybee Production System, Challenges and Opportunities in Selected Districts Of Gedeo Zone, Southern Nation, Nationalities and Peoples Regional State, Ethiopia International Journal of Research-Granthaalayah. 2016; 4(4):4963. Http://www. granthaalayah.com
14. Belie T. Honeybee production and marketing systems, constraints and opportunities in Burie District of Amhara Region, Ethiopia. MSc thesis (Animal Production). Bahir Dar University, Bahir Dar (Ethiopia), 2009, 116. http://hdl.handle.net/10568/721.
15. Haftom Gebremedhn, Zelealem Tesfay, Girmay Murutse, Awet Estifanos. Seasonal honeybee forage availability, swarming, absconding and honey harvesting in Debrekidan and Begasheka Watersheds of Tigray, Northern Ethiopia. Livestock Research for Rural Development. 2013; 25(4). http://www.lrrd.org/.
16. Abebe Jenberie Wubie, Amssalu Bezabeh, Kefelegn Kebede. Floral phenology and pollen potential of honey bee plants in North-East dry land areas of Amhara region, Ethiopia IOSR Journal of Agriculture and Veterinary Science (IOSR-JAVS). 2014; 7(5):2319-2380. www.iosrjournals.org.
17. Gidey Y, Bethelhem K, Dawit K, Alem M. Assessment of beekeeping practices in Asgede Tsimbla district, Northern Ethiopia: Absconding, bee forage and bee pests. African Journal Agricultural Research. 2012; 7(1):1-5. DOI: 10.5897/AJAR10.1071
18. Gichora M. Towards Realization of Kenya's Full Beekeeping Potential: A case Study of Barin District. Ecology and Development Series. Cuvillier Verlag Gottingen, Germany. 2003; 6:157.
19. Edessa N. Survey on honey production systems in West Shewa Zone. Fourth National Annual Conference of the Ethiopian Beekeepers Association (EBA), Addis Ababa, Ethiopia. 2005, 60-69.
20. Desalegn B. Assessment on the effect of ant (Dorylusfulvus) on honeybee colony (*Apis mellifera*) and their products in West and Southwest Shewa Zone. Proceedings of fifth National Annual Conference of the Ethiopian Beekeepers Association (EBA), Addis Ababa, Ethiopia. 2007, 13-25.