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Identification of Honey Source Bee Floras During Major and Minor Honey Harvesting Seasons in Jimma Zone, Southwest Ethiopia

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Abstract
In this study, honey source bee floras of major and minor honey harvesting seasons were assessed in Jimma zone, Southwest Ethiopia. Purposive sampling technique was used to select nine kebeles; three from each of three selected agro-ecological districts (Gera-highland, Gomma-lowland and Shebe-sombo-lowland). A random sample of ninety beekeepers was interviewed using a structured questionnaire. Key informant interview was done with all study district's beekeeping expert, development agents (DAs) of the study area and some individual beekeeper. The mean beekeeping experience of the respondents in the study area was around fourteen (13.59 ± 9.745) years. The maximum mean experience (22.5 ± 11.84 years) was observed at Anja-genbo kebele, in low-land agro-ecology. The lowest mean experience (8.3 ± 3.164 years) was observed at Choche-lemi kebele, in midland agro-ecology. In the range of 1 to 3 times per year, the mean honey harvesting trend per district was 1.73 ± 0.45 (Shebe-sombo/lowland), 2.17 ± 0.45 (Gomma/midland) and 2.23 ± 0.62 (Gera/highland). Understanding the honey source floras and their ecology is vital for implementation of the management practices of their habitats. Common honey source floras mentioned by beekeepers in all of the three agro-ecologies were Vernonia Spp., Coffee arabica and Croton macrostachyus. Guizotia scabra, and Bidens spp. were common honey source floras in lowland and midland agro-ecology. Based on the responses, there were some dominant bee floras in each agro-ecology for the source of honey namely: Schefflera abyssinica in the highland and Combretum molle in the lowlands. Ethiopia generally has diverse habitat and flora for honey bees.
Keywords: beekeeping; Ethiopia; flora; Jimma zone; honey; honey source;

Introduction

Ethiopia is home to diverse plant species that provide surplus nectar and pollen rewards to foraging bees (Girma, 1998). Ethiopia has considerable potential in beekeeping with rich flora, good ecological conditions and existence of large amount of colonies (Fichtl & Admasu, 1994). Production of honey depends mainly on availability of floral resources (bee forage). Traditional beekeeping accounts for 96.23% of the honey production and almost all the beeswax produced in the country, the remaining 3.77% includes 1.22% transitional and 2.55% modern beekeeping (FDRE-CSA, 2015). Of all the countries in the world, probably none has a longer tradition of beekeeping than Ethiopia. Since the fourth century, during the time of king Ezana, Christianity with a strong emphasis on a monastic culture contributed a lot to the intensive growth of beekeeping because of the need for wax for religious ceremonies (Fichtl & Admasu, 1994). Honey production is also considered a natural resource-conserving and environmentally friendly activity (Gidey & Mekonen, 2010). The honey production process does not require extra land. Instead of clearing forest, as many do to grow crops, the local people need to maintain the forest to produce a substantial amount of honey. Nuru, (2007) noted that beekeeping is an environmentally friendly activity and beekeepers are more aware about the importance of conservation of natural resource than any ordinary farmers.

Honey is a very complex natural product that contains sugars, organic acids, amino acids, proteins, minerals, vitamins, lipids, aromatic compounds, flavonoids, pigments, waxes, pollen grains, enzymes and other phytochemicals (Gomes *et al*. 2010; Almeida-Muradin *et al*. 2013). Honey has distinct and unique flavor, aroma, color and composition that depend on a lot of variables: nectar composition of the flora source, bee species, climate, environmental and seasonal conditions, agricultural practices, geographical origin, and techniques used during honey extraction and storage (Castro *et al*. 2010; Almeida-Muradin *et al*. 2013). Honeys may be classified as mono-floral or poly-floral depending on whether a dominating pollen grain, originated from only one particular plant (mono-floral honey) or no dominant pollen type in the sample is found (poly-floral honey) (Moussa *et al*. 2012).

Generally, assessing the potential bee flora and their importance as a major or minor honey source plant is very important in bee forage management. In this case, the identification of the important honey bee plants in the development of bee keeping has positive impact. This in turn requires the proper identification of honey bee plants and establishment of floral calendar. According to FDRE-CSA, (2015) survey report revealed that -a total of about 5.89 million hives/bee colonies were estimated to be found in the rural sedentary areas of the country, where Oromia regional state has a total of 2,864,320 bee colonies; of which 570, 241 bee colonies (one fourth of the region) were found in Jimma zone. The estimate of total honey production was about 48.71 million

kilograms. Agro ecological zones of Jimma zone are suitable for the growth of different bee flora and development of apiculture. Tolera and Dejene, (2014) reported that Jimma Zone has considerable potential in beekeeping with rich flora, good ecological conditions, existence large colonies population. This study is thus expected to contribute towards the development of beekeeping, thereby contributing to the overall improvement in food security; documentation and conservation of major and minor honey source floras.

Objectives of the study

The study aims to identify major honey bee floras for honey production (trees, shrubs, herbs, grass and weeds) and to set the baseline information for bee flora calendar establishing.

The specific objectives area to:

- assess major and minor honey source plants in the selected districts and to have the baseline information on the seasonal honey harvests
- indicate the major mono and multi-floral honey source bee forage in different agro-ecological zone of Jimma zones and to identify the major and minor months of honey production.
- suggest research, extension, policy and development intervention options that enhance utilization or application of bee management for efficient utilization and increasing production and productivity of hive products.

MATERIALS AND METHODS

Description of the study areas

This survey study was conducted in Jimma Zone, Oromia Region of Southwest Ethiopia. Three (3) districts (Shebe-sombo/lowland, Gomma/midland and Gera/highland) were purposively selected out of the existing seventeen districts in the zone. To represent the three agro-ecological regions and beekeeping potential areas, three Kebeles were purposively selected from each district; hence, a total of nine Kebeles. The nine Kebeles were selected based on information that the areas have beekeeping potential. They are Anja-genbo, Gasera and Keshe from Shebe-Sombo districts; Bulbulo, Choche-lemi and Omo-funtule from Gomma; Genji-chala, Gera-naso and Wanja-kersa from Gera. Primary data was collected from a random sample of 90 beekeepers from the selected nine agro-ecological Kebeles.

Gera district is located in the mountainous forest area. It has rugged terrain with an altitude ranging from about 1500 m to 2900 m. The average annual maximum and minimum temperatures are 26ºC and 10ºC, respectively. Due to this favorable climate, Gera has an average annual precipitation of 1700 mm and 113,514 ha of forest (Cheng *et al*., 1998). Gomma district is located in mid-altitude sub-humid zone of the south western part of Ethiopia. Its altitude ranges from 1400 to 2270 meters above sea level. The mean annual rainfall varies between 1400 and 1650 mm with average maximum and minimum temperatures of 29.9 ^{O}C and 13.4 ^{O}C, respectively (IPMS, 2007).

Social Survey Data Collection

To collect the required social data for the study individual interview, key informant interview and focus group discussion were conducted using a structured questionnaire as interview guide.

Household interview: to select sample household beekeepers for the study's first discussion were made with district experts. Three kebeles were selected per district randomly. 10 beekeeper households were selected from each Kebele. Accordingly 30 beekeepers households per district were used for the interview. For this study a sample of 90 individual beekeepers were individually interviewed. Information regarding bee forage plants and related parameter were collected such as beekeeping experience in year, identification of common bee flora with their flowering time, importance, seasonal forage availability, honey production and major honey contributing plants, season of honey harvesting, number of bee-colony kept per hive types, etc. The research team took local names, pictures and visual observations of the mentioned bee floras to further search for their scientific/botanical names and to prepare a plant-press.

Key informant interview: Key informant interview was done with all study district beekeeping expert, development agents (DAs), and some individual beekeeper in the study area. The qualitative information collected in interview was used to supplement and crosscheck the data obtained through the household survey. Purposive sampling method was used for selecting members for the key informant interview.

Focus Group Discussions: Focus group discussions were conducted in the study area with purposively selected PA leaders, DA, bee technicians, and some beekeepers, who are believed to be knowledgeable about bee flora/plants in the area. Purposive sampling method was used in selecting respondents for focus group discussion.

Statistical Analysis

The data collected during the social survey were summarized using descriptive statistical methods (such as frequencies, percentage). Descriptive statistical procedures were done with the aid of SPSS version 20 and excel 2007.

Result and Discussions

As indicated in Table 1 below, the mean beekeeping experience of the respondent in the study area were around fourteen (13.59 ± 9.745) years. The maximum mean experience (22.5 ± 11.84 years) was observed at Anja-genbo kebele), in lowland agro-ecology. The mean experience was about seventeen (16.7 ± 11.995) years. The lowest beekeeping experience (8.3 ± 3.164 years) was observed at Choche-lemi kebele in midland agro-ecology. In ascending order, the overall observed mean beekeeping experience of the respondents in the study areas per district were 11.07 ± 8.085 years (Gomma), 13 ± 8.077 years (Gera) and 16.7 ± 11.995 years (Shebe-sombo).

Table 1: Beekeeping experience and honey harvesting trends in the study areas

Districts and Kebeles	Average No of years of beekeeping experience, ± SD	Average of honey harvesting /yr ± SD
1, Gera/Highland	**13.00 ± 8.077**	**2.23 ± 0.62**
Genji-chala	14.10 ± 7.49	2.20 ± 0.60
Gera-naso	11.22 ± 7.26	1.78 ± 0.42
Wanja-kersa	13.45 ± 9.61	2.64 ± 0.44
2,Gomma/Midland	**11.07 ± 8.085**	**2.17 ± 0.45**
Bulbulo	13.80 ± 10.58	2.20 ± 0.60
Choche-lemi	8.30 ± 3.16	2.20 ± 0.40
Omofuntule	11.10 ± 8.48	2.10 ± 0.30
3, Shebsombo/Lowland	**16.70 ± 11.995**	**1.73 ± 0.45**
Anja-genbo	22.50 ± 11.84	1.70 ± 0.46
Gasera	10.30 ± 9.46	1.90 ± 0.30
Keshe	17.30 ± 12.26	1.60 ± 0.49
Grand Mean	**13.59 + 9.74**	**2.04 ± 0.56**

Honey harvesting trends of respondents in the study areas were in the range of 1-3 times per year (Table 1). The mean honey harvesting trends per districts in ascending order were 1.73 ± 0.45, 2.17 ± 0.45and 2.23 ± 0.62 times per year for Shebe-sombo, Gomma and Gera respectively. Based on the result the mean honey harvesting trend was two times per year, it is supported by FDRE-CSA, (2015) report which is average frequency of honey harvesting per year was 1.63. Gemechis (2014) reported that generally in Ethiopia there are two honey harvesting seasons: the major one that lasts from October to November and the secondary one from April to June. There are also many small honeys harvesting periods which depend on the type of flowering plants and rainfall patterns in different agro-ecologies (Nuru, 2007).

The trend of honey harvesting from a single traditional hive is once per year. After harvesting honey the bees were scattered there and the hives were collected for the next season. Meanwhile, frame and transitional hives were kept around the home and honey was harvested one to three times per year with lifting some combs/brood box for bees.

Table 2: Number of bee colonies found per hive types of respondents in the study areas

Locations (Districts and Kebeles)	No of respondents	Number of bee colonies found in the hive types: Traditional hives	Frame hives	Transitional hive	Mean of bee colony found per: Traditional hives	Frame hive	Transitional hive	Total	Mean of total
Gera (Highland)	30	**1001**	**313**	**85**	**33.37**	**10.43**	**2.83**	**1399**	**46.63**
Genji-chala	10	480	147	60	53.33	16.33	6.67	687	68.7
Gera-naso	10	301	77	2	30.1	7.7	0.2	380	38
Wanja-kersa	10	220	89	23	20	8.09	2.09	332	33.2
Gomma (Midland)	30	**197**	**285**	**15**	**6.57**	**9.5**	**0.5**	**497**	**16.57**
Bulbulo	10	33	40	11	3.3	4	1.1	84	8.4
Choche-lemi	10	36	137	2	3.6	13.7	0.2	175	17.5
Omo-funtule	10	128	108	2	12.8	10.8	0.2	238	23.8
Sheb- sombo (lowland)	30	**357**	**16**	**0**	**11.9**	**0.53**	**0**	**371**	**12.37**
Anja-genbo	10	138	7	0	13.8	0.7	0	145	14.5
Gasera	10	81	9	0	8.1	0.9	0	88	8.80
Keshe	10	138	0	0	13.8	0	0	138	13.8
Grand Total	**90**	**1555**	**614**	**100**	**17.28**	**6.82**	**1.11**	**2269**	**25.19**

Numbers of bee colonies found per hive types of respondents in the study areas were presented on table 2 above. It is estimated that Jimma zone has about 547, 241 bee colonies across the different ecological zones

(FDRE-CSA, 2015). Total number of bee colonies recorded among the ninety (90) respondents was 2, 269, based on this the mean number of bee colonies per beekeeper were around 25. Those bee colonies were kept in three different types of hive. 1,555 (68.54%) bee colonies were in traditional hive, 614 (27.06%) bee colonies were in frame/box hive and the rest 100 (4.4%) were kept in transitional hive. This shows that in the study areas, more of traditional beekeeping system was practiced. Kassaye, (1990) noted that traditional beekeeping is the major and oldest type of beekeeping practiced in Ethiopia for thousands of years. It is characterized mainly by forest beekeeping which is common in forest covered south and southwest Ethiopia (Nuru, 2007). This is carried out by hanging the traditional beehives on trees far away from their homestead in the forest. The presence of large number of bee colonies in frame hive within some Kebeles of Gera and Gomma districts, were due to Non-Governmental Organization's (NGO's) involvement.

In this study those honey source plants considered were only mentioned by respondent beekeepers who harvest honey during their major and minor honey flow season. Understanding the honey source floras and their ecology is vital for implementation of the management practices of their habitats. Having best management practices of floral ecology is vital for the sustainability and growth of the honey industry. All interviewed beekeepers experienced that, specific types of flowering trees are more preferred than others to attract bee colonies and honey production. The name of the honey they produce/harvest was based on the dominant plants which give flower before they harvest. Honey source floras mentioned by beekeepers during major honey harvesting season were described in Table 3. The major and minor honey harvesting season depended on the amount of honey obtained. The distribution and type of honey bee floras (honey source plants) as well as their flowering duration vary from one place to another place due to variation in biotic and abiotic factors like topography, climate (rainfall, relative humidity, temperature etc), soil, and farming practices. The common major honey source floras found/mentioned in all the three agro-ecologies were *Vernonia Spp. and Coffee arabica* and *Croton macrostachyus; Guizotia scabra, and Bidens spp.* were common bee floras in lowland and midland agro-ecology of the study areas.

Gera district has been a major honey-production area throughout history (Mohammed, 1990). The interviews, which were conducted with 30 beekeepers in Gera district of highland agro-ecology, revealed that *Schefflera abyssinica* was the major (25 respondents) honey source flora; they harvest honey from between April and May. Other three beekeepers told that they have two major honey harvesting seasons from two different honey source floras *Vernonia Spp. a*nd *Schefflera abyssinica*: Febuary.-March and April-May respectively. The rest beekeepers told that there is a mix of harvesting honey from different honey source floras in the month of April,: *Schefflera abyssinica* with *Coffee Arabica* and *Schefflera abyssinica* with *Maesalance olata* (Table 3). Beekeepers and local people easily associate the harvesting season with the botanical origin of honey (Gemechis, 2013). According to Yoshimasa (2014), Gera honey harvesting takes place in the short dry season starting at the end of April until the beginning of June, right before the long rainy season, when the most honey has accumulated. Beekeepers learn the predominant nectar sources of their region; based on this result we can suggest that *Schefflera abyssinica* is a major mono floral honey source tree in the area. Mono-floral honey is a type of honey which has a distinctive flavor or other attributes due to its being predominantly from the nectar of one plant species. This finding is supported by Fetch and Admasu (1994), who reported that *Schefflera abyssinica* is one of the most important honey trees of the country. It has abundant pollen and nectar which honeybees collect from the flowers throughout the day. It yields large quantities of light and pure white honey which fetches the best prices. It was also recommended for planting to increase honey production.

Kebeles in Gomma district, midland agro-ecology, mentioned that the honey source floras during major honey harvesting season were *Croton macrostachyus, Vernonia Spp, Coffee arabica, Strychnos spinosa,Guizotia scabra and Bidens spp.* The beekeepers responded that from these honey source floras they produce mono flora honey like *Croton macrostachyus* (9 respondents) from April – June, and *Vernonia Spp (*3 respondents) from March – April.; Aand poly flora honeys like *Vernonia Spp, Coffee arabica, Strychnos spinosa, Croton macrostachyus, Guizotia scabra, and Bidens spp* at their specific flowering season (Table 3). From table 3, eight respondents produce honey of *Guizotia scabra and Bidens spp.* (October-November) and *Croton macrostachyus*in (June). In other words, those eight beekeepers have two major honey harvesting seasons from different flora sources.

According to Fetch and Admasu (1994), *Vernonia Spp* (Gerawa) is a very valuable honey source in the country. In warmer areas the nectar secretion is abundant and bees produce a significant surplus of a dark aromatic honey. Honeybees generally collect the nectar and whitish pollen throughout the day. During flowering time honeybees develop very rapidly with a tendency to swarm easily.

Table 3: Honey source floras and months of major honey harvesting season in the study areas

Agro-ecology & local name of honey source bee floras	Botanical name (scientific name) of floras	Frequency of respondents	Month of honey production
Gera (Highland)		**30**	
Buto (Getema)	*Schefflera abyssinica*	25	April- May
Buto (Getema), Buna	*Schefflera abyssinica, Coffee arabica*	1	April
Buto (Getema), Abeyi	*Schefflera abyssinica, Maesalance olata*	1	April
Gerawa/Buto (Getema)	*Vernonia Spp./Schefflera abyssinica*	3	Feb.-March/ April-May
Gomma (Midland)		**30**	
Besana(Mekenisa)	*Croton macrostachyus*	9	April - June
Gerawa, Buna/ Besana	*Vernonia Spp, Coffee arabica/Croton macrostachyus*	1	June
Gerawa (Ebicha)	*Vernonia Spp*	3	March –April
Gerawa/ Bedesa, Besana	*Vernonia Spp./ Strychnos spinosa, Croton macrostachyus*	1	March/ June
Gerawa/ Besana	*Vernonia Spp./ Croton macrostachyus*	5	March –April/ May June
Tufo(mech maget), Kelo /Gerawa	*Guizotia scabra, Bidens spp./Vernonia Spp*	1	November/March
Tufo(mech maget), kelo(Adeyabeba)	*Guizotia scabra,Bidens spp.*	2	November
Tufo, kelo/Besana	*Guizotia scabra, Bidens spp. /Croton macrostachyus*	8	October-Nov./ June
Sheb-sombo (Lowland)		**30**	
Abalo, Gerawa, Tenesa	*Combretum molle R, Vernonia Spp, Combretum molle*	1	April
Gerawa, Buna	*Vernonia Spp, Coffee arabica*	4	March - May
Gerawa,Buna/ Tenesa, Besana	*Vernonia Spp, Coffee arabica/Combretum molle, Croton macrostachyus*	2	February/March-May
Tenesa, Buna, Gerawa	*Combretum molle , Coffee arabica, Vernonia Spp*	1	April
Tenesa	*Combretum molle*	7	March - May
Tenesa, Gerawa	*Combretum molle, Vernonia Spp*	6	April - May
Tufo(mech), kelo(Adeyabeba)	*Guizotia scabra, Bidens spp.*	9	November-December

In Shebe-Sombo district, lowland agro-ecology part, during major honey flow season beekeepers produce honey from different honey source floras. Among the honey source floras mentioned by the respondent beekeepers were *Combretum molle, Vernonia Spp*, *Coffee arabica*, *Combretum molle*, *Guizotia scabra* and *Bidens spp* (Table 3). Among the 30 respondents nine of them produce honey of *Guizotia scabra,and Bidens spp* from November- December; six of them produce honey of *Combretum molle, and Vernonia Spp* from April – May; and seven of them produce honey of *Combretum molle* from March – May as mono-flora honey. As *Schefflera abyssinica* is unique to highland agro-ecology and *Combretum molle* is unique flora to lowland agro-ecology for honey production, those beekeepers believe that the flowers of these trees are rich in nectar and high-quality honey will be produced. They often name the honey harvested after the tree species in which they are produced. Based on this, some beekeepers harvest honey of different floras which flower consequentially for example, *Vernonia Spp.* with *Coffee arabica; Vernonia Spp* with *Combretum molle; Croton macrostachyus* with *Strychnos spinosa,*(appendix) etc.

Table4: Honey source floras and months of minor honey harvesting season in the study areas

Agro-ecology and local name of honey source floras	Botanical Names	frequency	Months of honey harvesting
Gera/highland agro-ecology		**29**	
Besana (Mekenisa)	*Croton macrostachyus*	6	June-July
Gerawa (Ebicha)	*Vernonia Spp*	5	Feb-March
Gerawa,Bedesa	*Vernonia Spp.Strychnoss pinosa,*	1	March
Gerawa/Besana	*Vernonia Spp / Croton macrostachyus*	2	Feb/June-July
Gerawa,Buna,Bedesa	*Vernonia Spp., Coffee arebica,Strychnoss pinosa*	1	March
Gerawa/Qerero,Besana	*Vernonia Spp , Acokanther aschimperi/ Croton macrostachyus*	1	Feb/June
Gerawa,Reji,Buna/Besana	*Vernonia Spp,Vernonia rueppellii Sch.,Coffee arebica/Croton macrostachyus*	1	March/June
Gerawa,Tekurenchet	*Vernonia Spp, Prunusafricana*	1	March
Gerawa/Besana	*Vernonia Spp/Croton macrostachyus*	9	Feb-March/ June-July
Gerawa,Qerero,Buna/Besana,Bedesa	*Vernonia Spp , Acokanther aschimperi, Coffee arebica/Croton macrostachyus, Strychnoss pinosa*	1	Feb/ June
Tufo/Besana	*Guizotiascabra/ Croton macrostachyus*	1	November/June
Gomma/midland agro-ecology		**29**	
Besana(Mekenisa)	*Croton macrostachyus*	2	May-June
Gerawa	*Vernonia Spp*	4	February
Gerawa, Gerare	*Vernonia Spp,Acacia spp*	1	Feb-March
Gerawa/Besana	*Vernonia Spp/Croton macrostachyus*	1	January/June
Gerawa,Buna	*Vernonia Spp, Coffee arebica*	4	March-April
Gerawa,Buna/Besana	*Vernonia Spp , Coffee arebica/Croton macrostachyus*	1	March/May
Tufo/Besana	*Guizotiascabra/ Croton macrostachyus*	1	Nov/ June
Tufo/ Gerawa	*Guizotiascabra/ Vernonia Spp*	2	Nov-Dec/Feb
Tufo(mech)/Gerawa, buna	*Guizotiascabra/ Vernonia Spp, Coffee arebica*	2	Dec/Feb-March
Tufo(mech), kelo(Adeyabeba)	*Guizotiascabra, Bidens spp.*	11	Oct-November
Sheb-Sombo		**22**	
Besana	*Croton macrostachyus*	1	June
Gerawa ,Buna/Tenesa/Besana	*Vernonia Spp , Coffee arebica/Combretum molle/ Croton macrostachyus*	1	Feb/April/June
Tenesa, sesa, Abalo	*Combretum molle,Albiziagummifera,Combretum molle R.*	2	April
Tenesa	*Combretum molle*	1	April
Tenesa/Besana	*Combretum molle/ Croton macrostachyus*	2	April/June
Tenesa, Abalo	*Combretum molle,Combretum molle R.*	1	March - April
Tenesa	*Combretum molle,*	1	March
Tufo, Kelo	*Guizotiascabra, Bidens spp.*	12	Oct- November
Tufo, Kelo/ Besana	*Guizotiascabra, Bidens spp./ Croton macrostachyus*	1	Dec/June

Table 4 shows honey source floras and months of minor honey harvesting season along the agro-ecology in the study areas. In the highland agro-ecology of Gera district, honey was harvested from *Vernonia Spp.* alone and with other honey source plants during their minor honey flow season from February to March. There was also a possibility of mono-flora honey harvesting from *Croton macrostachyus* from June to July. In highland of Gera district generally, *Vernonia Spp* and *Croton macrostachyus* were the main honey source plants.

In midland agro-ecology of Gomma district also, honey was harvested from *Vernonia Spp* and *Croton macrostachyus* individually and with other honey source plants during minor honey flow season. *Guizotia scabra* and *Bidens spp* were the main honey source plants from October to November. From this result we conclude that the beekeepers understand that they harvest honey of different floral source at a time.

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Conclusion and Recommendation
This study was conducted to assess honey source bee floras during major and minor honey harvesting season in Jimma zone, Southwest Ethiopia. Common honey source floras mentioned by beekeepers in all the three agro-ecologies were *Vernonia Spp., Coffee arabica* and *Croton macrostachyus. Guizotia scabra, and Bidens spp.* were common honey source floras in lowland and midland agro-ecology. Based on the responses there are some dominant bee floras in each agro-ecology for the source of honey like *Schefflera abyssinica* in the highland and *Combretum molle* in the lowlands. Ethiopia generally has diverse habitat and flora for honey bees. Beekeeping (honey production) is also considered a natural resource-conserving and environmentally friendly activity. It does not require extra land. If there is good apicultural practice in the zone, there is a possibility of year round honey production applying frame hive, intensive hive management and hive inspection regularly. Knowledge of bee forages, and honey source plants are important to assist beekeepers in establishing appropriate colony management calendar, honey flow season, site selection and determination of carrying capacity. The botanical origin of honey has to be determined using pollen analysis methods.

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Appendix

Some pictures of the major representative bee floras found in the study areas were presented below.

Schefflera abyssinica *Vernonia Spp*

Croton macrostachyus *Coffee arabica*

Combretummolle
(Photo by Abera Hailu)