



## RESEARCH ARTICLE

### Assessment of Current Beekeeping Management Practice and Honey Bee Floras of Western Amhara, Ethiopia

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#### ABSTRACT

The study was conducted in 2010 with the objective of characterizing the current honeybee production system and identifying major and minor honeybee flora species with their corresponding floral calendar in Western Amhara. In this study, 27 representative kebeles from nine zones were purposively selected based on their honeybee production potential and floral coverage. Semi-structured questionnaire, checklists and field observation were used to collect the required data. A total of 56 beekeeper farmers were selected purposively for the interview purpose. SPSS (version 16) was used to analyze the data. According to this study there are three main honeybee production systems based on the type of bee hives used, namely the traditional, transitional and modern beekeeping. Within these production systems, 28.6% of the respondents emphasized that colony transferring was practiced during August and September while 20.25% of them transfer their colony in June. In the study areas there are two honey harvesting seasons, the main and the first seasons are October to December (52.6%) and the second are April to June (30.8%). From the total respondents used for the survey, 75% indicated that they plant different pollen and nectar source honeybee forages around their homesteads. According to the respondents the peak months in which feed shortage occurs are April (17.3%), March (16.2%) and February (16.2%). During these dearth periods 62.5% of beekeepers give additional feed like sugar syrup, honey syrup and, hot pepper to keep the strength of their colony and to get additional honey yield. Beekeepers also indicate January, December (23.1%) and April (15.4%) were the main months which colony migration occurs. Respondents (30.4%) indicate that September, October (28.1%) and November (42.1%) were the main seasons on which colony swarming occurs. April (17.8%), July (13.3%), and January (11.1%) take the first three main colony absconding months in the surveyed area. In western Amhara more than 249 major honey bee floras including trees, shrubs, bushes, crops, spices, flowering weeds, and grasses were also reported as a source of pollen and nectar. In general, from this study it was noted that beekeeping in the study area have practiced for getting additional income with its challenges. Therefore it is wise to invest on the sector for improving the income through integrating with natural conservations and further research activities on identification and characterization of poisonous plants indicated by beekeepers were recommended.

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#### INTRODUCTION

Beekeeping is a very long-standing and deep-rooted household activity for the rural communities of Ethiopia that stretches back into the millennia of the country's early history. It seems as old as the history of the country and it is an integral part of the life style of the farming communities (Adebabay *et al.*, 2008).

The contrasting geomorphic landscapes of Ethiopia create favorable environment for the existence of a large and unique biodiversity both in plants and animals including honeybee subspecies (Kerealem, 2005). Under Ethiopian context in general and Western Amhara in particular, beekeeping is practiced in backyards by keeping beehives under separate shelters or around the house wall or even inside the house with domestic animals

and family members (Adebabay *et al.*, 2008). Beekeeping activities in Ethiopia mainly constrained by inability in the transformation, promotion, scaling up to rapid growth, lack of commercial beekeeping development and beekeeping technology, limited credit supply, quality issue, lack of market access and information transmissions (Ayalew Kassaye, 2008). These related and interrelated problems limit the country from getting the potential benefit from the sub-sector.

Beekeeping is also a very long-standing practice in the farming communities of Amhara region and it plays a significant role as source of additional cash incomes and nutrition for many subsistence farmers (Nuru, 2002). It is an integral part of the smallholder farming system. Some recent studies indicated that the region has immense beekeeping resources attributed to existing bee floras, various cultivated oil crops, pulse and field flowers.

Among many factors, availability of potential flowering plants and ample sources of water for bees are the two major parameters for an area to be considered as potential honey production (Adebabay *et al.*, 2008). In this regard, there are over 7000 species of flowering plants existing in Ethiopia and these mainly comprise natural trees, forage plants, horticultural and cultivated crops (EARO, 2000). However, not all of these are useful to honeybees, and even those that provide bee forage vary in their value to beekeeping. There are also variations in the utility of a species depending upon the climate, soil and other factors in the place of its occurrence.

The potential of land for beekeeping depends on the nature of the vegetation it supports. Thus, vegetation characteristics of a region are considered to be an important indicator of its potential for beekeeping. As honeybees do not visit all plants for their nutrition, identification of the honeybee plants and assessing their abundance, their value to bees, time of blooming and flowering period have a paramount importance for practical beekeeping and in assessing the potential of an area for beekeeping (Nuru *et al.*, 2001; Amssalu, 2004) as well as in planning appropriate seasonal management and effectively uses of the resources. The floral calendar of an area however usually varies from year to year since flowering depends on the weather conditions (Nuru *et al.*, 2001; Gichora, 2003). So far, in the region detail studies on the types of bee plants, their flowering calendar as well as potentiality for beekeeping are not conducted. Therefore, the objectives of this study were;

- To assess the current beekeeping practices in Western Amhara region.

To identify major and minor honeybee flora species and design floral calendar for beekeepers of Western Amhara region.

## MATERIALS AND METHODS

For this study, 9 representative woredas of Western Amhara were purposively selected. From each woreda three sampling kebeles and, a total of 27 sampling kebeles were selected based on their potential for beekeeping, vegetation cover and altitude difference (Dega, Woina dega and Kolla). To understand the floral calendar and trend of vegetation coverage, individual and focus group discussion were used.

Semi-structured questionnaire and checklists were used to collect the main data on all flowering plants (trees, shrubs, crops, weeds and grasses) available in the area, and to characterize the honeybee production systems. A total of 56 beekeeper farmers were selected purposively by the assistance of woreda and Kebele experts. All the collected data were coded, tabulated, and organized for analysis. SPSS (version 16) were used to analyze the data. Multiple responses cross tabulation and descriptive statistics were used to present the results.

## RESULTS AND DISCUSSION

### Household information

The survey result indicated that 39.3% of respondents have more than 15 years of experience in beekeeping. It was also indicated that beekeeping activity is characterized by well-tailored indigenous knowledge to manage the honeybees according to the seasonal variations and environmental conditions.

From the result (Table 1) it is clear that in Western Amhara there is potential beekeeper with early age group and better educational level which has the advantages of easily grasping for any type of trainings in general and apiculture trainings in particular and apply it into practice to increase honey and other hive products. It is also rewarding to exert positive effort for those youngster beekeepers to integrate natural resource conservation with modern beekeeping technologies so as to get multiple results.

**Table 1:** Household information

Parameters	Variables	Frequency (N)	Respondents (%)
Educational level	Illiterate	12	21.4
	Read and write	14	25.0
	1-8 grade	20	35.7
	9-12 grade	8	14.3
	Diploma/degree	2	3.6
Age group	18-35	17	30.4
	36-45	15	26.8
	46-55	13	23.2
	56-65	8	14.3
	>65	3	5.4
Experience, years	more than 15	21	37.5
	10-15	7	12.5
	5-9	13	23.2
	1-4	14	25.0
	11	1	1.8

In this study, the sex of all the interviewed beekeepers was male. This is in line with the report of Hartmann (2004) as cited by Solomon who noted beekeeping as the men's job in Ethiopia and Solomon (2009) who noted the activity of men in Bale highlands of southeast Ethiopia. Beekeeping activities in the surveyed area can also be practiced by aged persons with >65 years old (Table 1), which is the advantages of beekeeping practice which can be practiced regardless of religion and physical disabilities. This result also in line with Nuru (2007) which states as beekeeping has an advantages of being practiced by women, aged men and persons with disabilities.

## Honeybee management activities in Western Amhara Region

### Colony transferring

The result revealed that in Western Amhara colony transferring is practiced during August, September with 28.6% each and June (20.2%) as these months are peak powering periods of the year which manifest the colony to build up itself and produce ample hive resources (86.4%), colony number and productivity with 6.8% each. Kerealem and his colleague also indicated that from mid-June to July in Dega agro-ecological areas and mid-August to September in Kolla and Woyna Dega agro-ecological areas are the peak colony transferring months. According to Adebabay *et al.* (2008), in Amhara region it was indicated that August to September and April to June as the season of colony transferring. In three months (December, January and February), colony was not transferred as farmers reasoned out; because of that these three months are the main once characterized as death period on which no or some flowers are available.

### Honey harvesting

In the study area majority of the respondents collect honey once in a year (73%) followed by twice (25%) and trice (2%). According to the respondents (39.3%), 5-6 kg of honey is harvested per local hive. This result agrees with the report of BoA (2004), 5-6 kg and Nuru (2007), 5-8 kg, respectively, from local hive per colony per annum. Besides, 5.4 and 17.9% of respondents indicated that more than 25 kg of honey is produced from top bar (both timber and non-timber made) hive and 11-20 kg from frame hives is harvested, respectively. The result also show that honey harvested from frame hive is less than that of top bar hive which might be due to dwindling of honeybee floras in the Western Amhara which urge the beekeeping who own frame hives to only harvest honey once in a year than who own top-bar hives; and in these case there is no suppering of hive for additional honey production.

October, November and December were regarded as the main honey flow season and harvesting period of the year as this period is the main flowering season of the year; whereas, May, April and June were regarded as the second honey flow season/ harvesting period of the year. This finding also agrees with the reports of Nuru (2007) that indicated these months as the two main honey flow and harvesting periods of the year. In the first honey harvesting period, the main reasons might be the presence of flowering crops and in the latter period, potential flowering ability of Eucalyptus tree. This result is in line with Nuru (2007) and Kerealem *et al.* (2009) who states that Eucalyptus tree is the main dominant and potential honeybee flora in Western Amhara region.

### Honey Grading

Beekeeper farmers (83.9%) give grade for the honey they collect in honey flow season using different criteria (Fig. 1). Beekeepers make use of grading parameters which are interrelated each other in that grading on one parameter based on the other and vice versa. The respondents indicated that the dominant colors of their honey were white and black. Beekeepers use color, season of harvest, ripeness, plant source and test as criteria for grading honey. They reasoned out that the color variation

is due to ripeness and season of harvest i.e., the white colored honey is the honey harvested in September and October (the first honey harvesting season) and the black colored honey is when the honey is not harvested in time (September) and the types of flowering plants bloom during harvesting season.

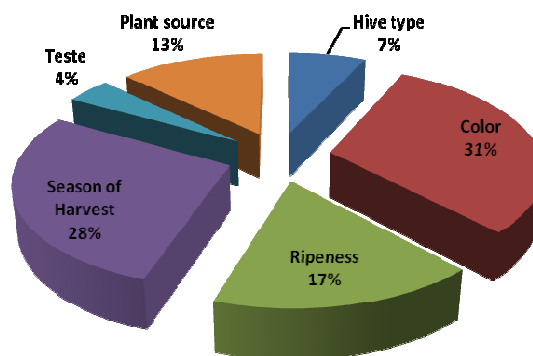


Fig 1: Parameters used for honey grading

The beekeepers (33.9%) grade their honey by season indicating that the honey harvested in October is preferred for its color attractiveness, medicinal value (because the honey is believed to be composed of nectar pollen of various flowering plants), and purchasers perception towards the honey. Beekeepers grading of honey based on plant source indicated that honey from Nug (*Guitozia abyssinica*), Adeyo (*Biden spp*), and Bahirzaf (*Eucalyptus spp*) take the first three grades in order of importance. Beekeepers, generally, indicated that honey harvested (produced) from cereal crops is mainly acceptable by individual users and purchasers due to the composition of the honey which is collected and mixed from them. The result also agree with Nuru (2007) and Adebabay *et al.* (2008) who indicated that in parts of the country other than South and the South West where the major plants are natural vegetations, crops like oil, pulse and cereal cover millions of hectare of land annually, serves as major honeybee plants. Even though flowering weeds are also important plants used as source of nectar, farmers indicated that the coverage and distribution of weeds is dwindling because of indiscriminate application of chemicals /pesticide.

Beekeepers also (55.3%) indicated that there are poisonous plants that have detrimental effect on honeybees and in turn indirect effect on humans during consumption of honey. The major reported poisonous plants are Bisana (*Croton macrostachy*), Bahirzaf (*Eucalyptus spp*), Kulkual (*Euphorbia spp*), and Simiza (*Justitia schemperina*) in their order of importance. Adebabay and his colleagues also reported that Bisana (*Croton macrostachy*) as poisonous honeybee flora in Amhara region. Beekeepers also indicated symptoms and cases related with those poisonous plants (Table 2).

### Seasons of feed shortage/ dearth period for honeybees

The survey result indicated that in all months of the year there was feed shortage for honey bee despite variation in severity. The peak months in which feed shortage occurs are April (17.3%), March, and February (6.2%). These months are indicated as dearth period

**Table 2:** The major honeybee floras known for their poisonous effect

Local name of plants	Scientific name	Number	Percentage	Symptoms and cases
Bisana	<i>Croton macrostachy</i>	12	21.4	Diarrhea, weakness and death of bees.
Bahirzaf	<i>Eucalyptus spp</i>	6	10.7	Weakness and death of bees, decreased colony population, heavy for feeding persons.
Kulkual	<i>Euphorbia spp</i>	5	9	Death of bees, disease on feeding persons.
Simiza	<i>Justitia schemperina</i>	4	7.1	Death of bees and disease on feeding persons.
Dikerence	<i>Acacia dicerence</i>	4	7.1	Disease on bees and feeding persons, death of bees.

**Fig. 2:** Wanza (*Cordia africana*) (left) and Bissana (*Croton macrostachy*) (right)**Fig. 3:** Adeyo (*Biden spp*) (left) and Meche (*Guizotia scabra*)

because there was no much flowering plant (BoA, 2004). In these seasons (62.5%) beekeepers have the tradition of providing supplementary feed to keep the strength of their colony and to get additional honey yield. This also in line with the report of Solomon (2009) who stated that during dearth period when there is little honeybee forage, beekeepers provided supplementary feeds. Beekeepers give additional feed for their honeybees when they think the time is dearth period (when there is no better pollen and nectar source).

According to beekeepers the peak dearth periods of the year are dry season period (December to March) as there is no flowering plant as a source of pollen and nectar and during rainy season (June to July) as the pollen of the flowering plants is diluted and the nectar is washed by the rain and referred as dearth period (BoA, 2004).

In the study areas, as beekeepers indicated, sugar syrup (27.8%), hot pepper (13.9%), roasted pea flour (11.4%), water (11.4%), honey syrup (7.6%), roasted bean flour, and roasted barley flour are the major feed types they used as a supplementary feed during dearth period.

### Migration, Swarming and Absconding

Beekeepers (19.6%) indicated that the seasons of which colony migration occurs mainly from December to April while June to November was months on which migration of colony was not recorded. Shortage of flora, chemical applications and unknown reasons are indicated as reasons of colony migration. This finding also agrees with the report of Nuru (2007) indicated that honeybee colony migration occurs when flowering period ceases, that is, when there is no pollen and nectar sources in the area.

Regarding season of colony swarming, beekeepers of the survey area (30.4%) indicated that September, October (28.1%) and November (42.1%) were the main months in which colony swarming occurs because of availability of pollen, vegetation coverage and instinct behavior of bees; while, February, March, April, July, and December were months in which there was no record of incidence.

Of the total respondents used for the survey, 55.4% of them indicate that April (17.8%), July (13.3%), and January (11.1%) as the first three main colony absconding months in their locality. As indicated by the beekeepers, incidence of pests and predators, poor management, and excessive weather conditions (sun, wind and rain) are the causes of colony absconding. The report by Adebabay *et al.* (2008) supports this finding as the main causes for colony absconding were incidence of pest, poor management, bad weather and others.

### Constraints of Beekeeping

According to the respondent beekeepers, the most devastating phenomena that curtails the productivity of honeybee colonies, is poisoning of honeybees by agrochemicals such as fungicides, pesticides, and herbicides. This daunting challenge not only affect the wellbeing of honeybees but also the wellbeing of human beings who utilizes its products and the ecology which honeybees are main actors in pollination of plants to keep the ecology balances. These days, it is not only an economic and ecological problem it is also becoming a social problem due to the conflict of interest between the beekeepers and non-beekeepers during the application of chemicals. The reports of Gidey Yirga and Kibrom Ftwi (2010) and Kerealem and his colleague (2009) reported the effect of pest and pesticides as the main bottleneck constraints of the beekeeping sectors in Northern Ethiopia and Amhara Region respectively. Additionally, the respondents also indicate that absence of pollen and nectar source forages, because of deforestation, as a second most problem in their area. In the report of Kerealem and his colleague (2009), this problem had reported as a first constraint in the sector. In short, these problems are technical, management and policy issues and can affect the production and productivity of beekeeping in the region,

**Table 3:** The main honey bee floras in W. Amhara Region

Local name of the plants	Scientific names	Frequency (N)	Flowering calendar
Trees, shrubs and bushes			
Bahir zaf	<i>Eucalyptus spp</i>	46	All over the year
Bissana	<i>Croton macrostachy</i>	36	February-August
Gerare	<i>Acacia spp</i>	33	December-May
Kega	<i>Rosa abissinica</i>	28	October-May
Wanza	<i>Cordial Africana</i>	28	Sept-November
Gerawa	<i>Vernonia spp</i>	26	Sep-May
Agam	<i>Carissa edulis</i>	24	February-May
Kulkual	<i>Euphorbia spp</i>	20	May
Crops and spices			
Nuge	<i>Guitozia abyssinica</i>	43	October
Bakella	<i>Vacia foba</i>	29	August
Gomenzer	<i>Brassica spp</i>	29	September/October
Ater	<i>Pisum sativum</i>	26	Augest-septmber
Bekollo	<i>Zea mays</i>	24	August- September
Zekakibie	<i>Ocmum basilicum</i>	17	
Weeds and grasses			
Meche	<i>Guizotia scabra</i>	40	Sept-October
Adeyo	<i>Biden spp</i>	37	September
Wazema	<i>Medicago polymorpha</i>	27	July-October
Maget	<i>Tripholium steudneri/acaule</i>	13	October/November
Gorteb	<i>Plantago lanceolata</i>	11	May-June
Serdo	<i>Eleusina floccifolia</i>	11	-
Fruits			
Mango	<i>Mangifera indica</i>	5	March
Birtukan	<i>Citrus sinensis</i>	5	April
Papaya	<i>Carica papaya</i>	4	March

which needs the coupled focus of the beekeepers as well as the regional government.

#### Major honey bee floras of Western Amhara Region

Based on the survey result, in Western Amhara Region, more than 249 honey bee floras including trees, shrubs, bushes, crops, spices, flowering weeds, and grasses were identified. From the total listed flora types, 156 of them are trees, shrubs, and bushes, 34 of them are crops and spices, 47 of them are weeds and grasses and 12 of them are fruits (Table 3).

#### Conclusion and Recommendation

Generally, from this study it can be inferred that Beekeeping in Western Amhara Region is practiced by potential beekeepers with young age group which have better educational level that have promising advantage for the future improvement of the sector. Currently the sector has coping up with various challenges on both feed sources and managerial practices. Natural enemies (pests and predators), lack of support and attentions on the sub-sector coupled with deterioration of the vegetation coverage because of computation of land for crop cultivation and settlements in the study area struggles beekeeping activities from further expansion. Because of settlements and intensification of crop production, the production system also changed and many types of vegetation are replaced by cash crops and trees like *Eucalyptus spp*, which was become dominant from time to time. *Eucalyptus spp* is now the potential honey bee plant in the study areas which flowers years rounding.

From the result obtained in the survey, the following points were strongly recommended for the future improvement of the sector.

- ✓ As there are young beekeepers and integrated production constraints, impressive training on

modern beekeeping practice should be given due attention

- ✓ The regional government, Bureau of Agriculture and Rural Development, Amhara Region Agricultural Research Institute, and NGOs should formulate policy and design legislations with regard to pesticide and insecticide application. Moreover, focus should be given to those chemicals which are not harmful to honeybees and chemical applications should not mach to the flowering seasons to minimize the poisoning of honeybees.
- ✓ Further research activities on characterization and identification of poisonous plants must be under taken

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