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Challenges and Prospects of Honey Bee Production in Ethiopia: A Review

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Abstract
In the present review an attempt has been made to briefly the major constraints and prospects of honey bee in the country so as to help the researchers to develop well-organized strategies to improve productivity and honey bee population in Ethiopia. Some important local honeybee plants (trees, shrubs, herbs and cultivated crops are known as a source of nectar and pollen in Ethiopia, namely *Becium grandiflorum*, *Hypoestes forskaolii*, *Leucas abyssinica*, *Euclea schimperi*, *Cordia Africana*, *Eucalptus spp, Vernonia amygdalina*, *Cordia africaca, Olea Africana*, *Guizotia scabra, Syzygium guineese*, *Croton machrostachyus* and *Opuntia ficus-indica* identified as the major bee forage in different parts of the country. honey badger, ants, wax moth, spider, birds, lizard and snake are identified as pests and predator to the bees in Ethiopia. From the above ants causes severe economic loss in honey production by killing bees, rob their products, lead to absconding and destroying the entire colony of honey bees. Pests and predators, beekeeping equipments, absconding, pesticides and herbicides, death of colony and swarming are the most important constraints present in Ethiopia. The present review indicated that beekeeping could be a great source of employment creation for the rural people to reduce poverty. Beekeeping plays an important role in income generation for beekeepers of Ethiopia. Basically, the country's policy for agriculture and rural development can be the first prospect to improve any agricultural sub sectors. This is general prospect to develop beekeeping sector all over the country but there is specific opportunities from the region to region.
Keywords: Challenges, Ethiopia, Honey bee, Prospects

INTRODUCTION

Ethiopia is endowed with diverse and unique flowering plants thus making it highly suitable for sustaining large number of honeybee colonies and long established of beekeeping. In Ethiopia, the land is not only favorable to bees, but also for different kinds of honeybee pest and predators (Desalegn, 2001). Pests and predators result in a great damage on honey bee colonies with in short period of time. Beekeeping is exceptionally sustainable as the activity has no impact on the environment and rather it stabilize fragile area and help in reclaiming degraded lands and increase biodiversity (Adgaba *et al*., 2014). The presence of good climatic conditions and diversified bee flora contributed for the existence of about five million honeys bee colonies in Ethiopia (CSA, 2013/14). The country is the largest honey producer in Africa and 10th largest honey producer in the world (Rivera *et al*., 2007).

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 products obtained from the subsector were still low as compared to the potential of the country (Edessa, 2005). Like all living animals, honey bees were infected with disease and attacked by parasites and pests endangering their health and life (Morse and Nowogrodzki, 1990; Al Ghzawi *et al*., 2009). These diseases of honey bees impose serious problem on honey bee production and productivity. This is because if it once occurs in the colony, they cause partial or total loss of colonies and most of them spread very quickly and difficult to treat (Haylegebriel, 2014). The present paper briefly reviews major reported challenges and prospects of honey bee in wide ecological bee keeping areas of Ethiopia. An attempt has been made to briefly the major constraints and prospects of honey bee in the country so as to help the researchers to develop well-organized strategies to improve productivity and honey bee population in Ethiopia.

Honey Bee Management Practices

For many farmers, beekeeping is one of their major activities in addition to livestock keeping and agriculture. In beehive management (follow up, checking against enemy, cleaning the environment, supplying additional feeding, watering and honey harvesting) bee keepers had experience. Majority (53.8%) of the respondents in Hadiya Zone southern Ethiopia inspect their hives some times (Haftu and Gezu, 2014). This is in line with Tessega (2009) reported that 46.7% inspect rarely in Amhara region, However, 94% of beekeepers have daily followed and checked their beehive against bee enemies in central Zone of Tigray (Haftu *et al*., 2015). Tesfaye and Tesfaye (2007) reported 53.5% of beekeepers visit their bees every day while 30.2% of them visit their bees at every three days and the rest visit their bees to check if the hive was occupied with bees and at least during

honey harvesting seasons in Adami Tulu. About 60.2 % of the interviewed beekeepers in Hadiya zone southern Ethiopia believe that visiting the apiary and hive during rainy season causes diseases (Haftu and Gezu, 2014).

Adoption of Inputs and Technologies to Improve Honey Bee Production

Improved box hives have been introduced and promoted in Ethiopia for the last 40 years yet adoption rate is low (Kerealem *et al*., 2009). Modern beehives allow honeybee colony management and use of a higher-level technology, with larger colonies and can give higher yield and quality honey. Inputs and appropriate honey bee technologies can be local practices or be adopted from other countries. Generally, adoption of improved bee hive practices may involve the transfer of appropriate new technologies and local experiences to be used in improving productivity of honey bee. The pace of adopting new technologies by farmers can vary due to controversial reasons. Beyene and Verschuur (2014) in south west shewa zone of Oromia reported bee equipments such as modern bee hives, wax printers and honey extractors are very expensive and thus farmers could not affordable to buy and use these equipments. Currently, the cost of one modern bee hive ranges from 900-1000 Ethiopia birr, the cost of honey extractor is ranges 4,000-5,000 Ethiopian birr and the cost of wax printer is ranges from 5,000-6,000 ETB. This leads to shortage of appropriate technologies for production, collection, processing, packing and storage. Improved bee equipments to the farmers are beyond their buying capacity, since most of them are resource poor and thus they are unable to buy and use modern bee technologies to improve honey yield. The high cost of modern bee hive discourages farmers from transferring local hive to improved hive; therefore construction of modern bee hive using locally available materials should be encouraged. Majority of respondents in the northern Ethiopian highlands had modern beehive to enhance honey production and increase their income (Teferi *et al*., 2011).

Harvesting and Preservation of Honey Bee Products

Teferi *et al*. (2011) indicated on average 33 and 16 kg of honey per hive was harvested from modern and traditional hives in the northern Ethiopian highlands respectively. Honey production is very low, only about an average of 8 to 15kg of honey could be harvested per hive per year but in areas where improved technology has been introduced, an average of 15 to 20 kg/hive/year has been harvested (Beyene and David, 2007). Addis and Malede (2014) and Chala *et al* (2013) reported that the average honey yield per year/colony was 7.20, 14.70 and 23.38kg for traditional, transitional and moveable frame hives, in around Gondar and in jimma zone, south-west Ethiopia respectively. Haftu and Gezu, 2014 in Hadiya Zone of southern Ethiopia also indicated 3.04, 4.9 and 8.2kg for traditional, transitional and moveable frame hives, respectively.

Honey can be harvested once or twice, while in some cases even three times in a year largely depending on the availability of bee forage as reported by (Haftu and Gezu, 2014 in Hadiya Zone of southern Ethiopia; Tessega, 2009 and Tesfa *et al*., 2013 in Western Amhara region). Haftu and Gezu (2014) indicated even though the majority (75%) of the households do not store honey primarily because of high demand for cash but some farmers keep some amount for different purposes and store using plastic containers, gourd, tin and clay pots until consumption or sale.. Beekeepers sell the largest proportion of their honey during harvest at low price mainly to meet their demand for cash for social obligations Beyene and Phillips (2007).

Honey Bee Products Demand and Consumptions

The estimate of total honey production in Ethiopia in 2011 is about 40 million kilograms of which the greater portion is harvested from traditional hives (CSA 2012). Recently, attempts have been made to address problems associated with production and marketing of honey. About 13% (of 169,000 holders contacted) have practiced honey and wax development package according to a survey by the same source. Currently, honey is produced in its crude form and consumed domestically largely by Tej (honey wine). However, Crude honey could be processed into several important marketable products. These products include purified honey, beeswax, propels, pollen, bee venom, and royal jelly. But, only a few enterprises are engaged in the processing of honey in Ethiopia and the processed products of those are limited to purified honey and beeswax (Gallmann and Thomas, 2012). Yetimwork *et al.* (2015) in eastern part of Tigray declared that both in traditional and framed hive, honey production is increasing from time to time.

At present, supermarkets, grocery shops and hotels are some of the major buyers of processed honey. According to the information obtained from supermarkets, the increasing expat community is also expected to constitute significant consumption of the product. Though there is no comprehensive consumption data for processed products in the country, an attempt has been made to arrive at an estimate of present demand. Processed honey is considered to be a commodity whose demand arises from urban population. According to CSA (2011), the population is 82 million out of which 13.75 million is urban dwellers. On the other hand, the per capita natural honey consumption is 60 grams. The apparent consumption of the product will therefore be 825,000 kg (or 825 tons). Hence, this figure has been taken as the present domestic effective demand (for year 2012) for processed honey. Future domestic demand for processed honey grows with the growth in urban

population and income rise. Hence, the urban population growth rate, that is 4 %, is applied in projecting the future demand.

Honeybee Flora and Dry Season Feeding

Some important local honeybee plants (trees, shrubs, herbs and cultivated crops are known as a source of nectar and pollen in Ethiopia, namely Tebeb *(Becium grandiflorum)*, Girbiya *(Hypoestes forskaolii)*, siwakerni (*Leucas abyssinica*), kiliow (*Euclea schimperi*), Awhi (*Cordia Africana*), Bahirzaf (*Eucalptus spp)* Girawa *(Vernonia amygdalina)*, Wanza (*Cordia africaca),* Wyira *(Olea Africana)*, Meche *(Guizotia scabra),* dogma (*Syzygium guineese)*, Bisana (*Croton machrostachyus)* and, beles *(Opuntia ficus-indica)* identified as the major bee forage in different parts of the country (Yetimwork *et al.,* 2015 in eastern part of Tigray; Haftom *et al*., 2013 in Debrekidan and Begasheka Watersheds of Tigray; Haftu and Gezu, 2014 in Hadiya zone of southern Ethiopia).

According to Tesfa *et al*. (2013) reported in Western Amhara region beekeepers supplement sugar syrup, hot pepper, roasted pea flour, water, honey syrup , roasted bean flour, and roasted barley flour during dearth period. Yetimwork *et al.* (2015) reported Supplementary feeding and migratory beekeeping practices to overcome the feed shortage at the dry season is a common practice. Majority of the beekeepers provide besso (roasted and grounded barley flour), shiro (roasted spiced pulses flour), sugar syrup and honey with water mainly from February to May in eastern part of Tigray.

Poisonous Plants and Honeybee Poisoning: Plants like akacha (*Acacia saligna*), qnchb (*Euphorbia species*); limo or false neem (*Melia azedarach)* and neem (*Azadirachta indica)* are identified as poisons plants (Yetimwork *et al.,* 2015 in eastern part of Tigray). According to Chala *et al.* (2012) report nectar or pollen of poisonous plants are toxic to the bees themselves and those in which the honey produced from their nectar are toxic to humans. In Ethiopia use of applications of agrochemicals (chemicals) for crop protection is another reason to cause for the death of honeybee especially if they are applied while the crop is in bloom (Tessega, 2009).

Constraint of Honey Bee Production

The most important constraints present in Ethiopia were bee forage, pests and predators, beekeeping equipments, absconding, honeybee colony, pesticides and herbicides, death of colony, water shortage, honey storage materials and swarming (Yetimwork *et al.,* 2015 in eastern Zone of Tigray; Haftu and Gezu, 2014 in Hadya Zone of southern Ethiopia). Similarly, Kerealem *et al*. (2009) declared that the major constraints that affect beekeeping sub-sector in Ethiopia are: lack of beekeeping knowledge, shortage of skills man power, shortage of bee equipments, pests and predators, pesticide threat, poor infrastructure development, shortage of bee forage and lack of research extension. A study conducted by Tesfaye and Tesfaye (2007), on honey production system in Adami Tulu to identify opportunities and threats on beekeeping and the results shows that most of the respondents (beekeepers) do not visit their bees regularly. Farmers did not have any type of beekeeping equipments and did not bother about their colonies while harvesting. The place where beekeepers put their beehives also considered as the major constraints. According to the beekeepers of Tigray Region, the critical constraints and problems affecting honey production include inadequate production technologies, limited availability of bee flora mainly due to deforestation, lack of beekeeping knowledge/skill, and marketing accessibility. And farmer's access to trainings is generally poor (Gidey and Mekonen, 2008).But all these problems may not be constraints to all parts of the country and may not be equally pressing to every place. So it requires characterizing the constraints in their respective places to take an appropriate development measure.

Shortage of Bee Forage: Beyene and Verschuur (2014) in south west shewa zone of Oromia indicated shortage of bee forage is directly related with deforestation of forest coverage from time to time for timber making, construction, fire wood and expansion of agricultural lands. To solve this problem beekeepers migrating their bee colonies from their area to other area during the dry season for searching bee forage., similarly, Haftu and Gezu (2014) in Hadiya zone southern Ethiopia declared shortage of bee forage was the most serious problem affect bee colony. The elimination of good nectar and pollen producing tree species in many areas make it difficult to maintain bee colonies without feeding (Kerealem *et al*., 2009).Due to deforestation and poising of agro-chemicals, the honey bee population is in state of continues declining. As a result, it has become a serious challenge to get honey bee colonies to start and expand beekeeping (Nuru, 2007).Beekeeping sector is dependent on healthy flora and a healthy environment. Recent years have seen environmental changes in Ethiopia in terms of erratic rain fall patterns and deforestation.

Major honeybee Pests and Predators: The honey bee colony is not immune from predation and it can take a variety of forms, from destruction of a comb by wax moth to physical dismembering of a colony by a hungry black bear. According to Yetimwork *et al.* (2015) and Adeday *et al.* (2012) honey badger, ants, wax moth, spider,

birds, lizard and snake are identified as pests and predator to the bees in eastern part of Tigray. Similar honeybee pests and predator was reported by in other parts of the country Tessega (2009) in Amhara region, Chala *et al.* (2012) in Gomma district of Jimma zone, South-west Ethiopia, Nubiyu and Messele (2013) in Gamo Gofa zone of southern Ethiopia, Tariku and Mechthild (2013) in Sidama Zone,Southern Ethiopia and Tesfaw (2012) in Ada'a district of east Shoa Oromia region, Ethiopia.

Ants are most disturbing to honey bees and bee keeping sector. Ants causes severe economic loss in honey production by killing bees, rob their products, initiate aggressiveness in bees, lead to absconding and destroying the entire colony of honey bees (Amssalu, and Desalegn, 1999). In Ethiopia ants were the series problem in bee keeping as reported by Awraris *et al*. (2012) in Keffa, Shako and Bench- Maji zone; Tesfaye and Tesfaye (2007 in Adami Tulu; Etsay and Ayalew (2001) in estern Tigray. In Tigray, Amhara and SNNP regional states and Gomma district Jimma zone bee keepers ranked ants as first problematic pest insect in honey bees (Amsalu *et al*., 2010). Bees are the first and most victim of the attack with ants followed by honey (Desalegn, 2007).

Problems of agrochemical: In Ethiopia farmers are producing mainly wheat, barley, teff, chick pea and different horticultural crops and they use chemical spray such as pesticide and herbicide for pesticides and weed controlling it cause bee colonies either die or absconded from their hive (Beyene and Verschuur, 2014). Similarly, Haftu and Gezu (2014) in Hadiya zone southern Ethiopia declared pesticides & herbicides application was serious problem affect bee colony. The chemical spray used by farmers is also destroying bee forage like herbs and shrubs which is used as sources of bee forage. The use of pesticides that kill bees and herbicides are not toxic to bee colonies but destroy many plants that are valuable to bees as sources of pollen and nectar such as Malathion, sevin, DDT, 2-4 and Acetone Kerealem *et al*, (2009). Insecticides have more devastate effect on bee colonies compare to herbicides.

Prospects of Honey Bee Production

The honey sector is one of the few sectors that had the most inclusive ability to achieve transformation and growth across all categories of rural households through increasing the income of the rural people. This is because of its large resource base and low barriers to entry (Paulos and Desalgne, 2012). Apiculture is a powerful way of tackling poverty at the grassroots level. Beekeeping could be a useful avenue for improving rural economy. Beekeeping should be considered as a great source of employment creation for the rural people to reduce poverty. The honey sub sector should be among the top priority for food security and poverty reduction programs in the country. Availability of natural forest, availability of water resources, Low barriers or ease entrance to the sector (this is because beekeeping activity need not require wide area of land as other activities of agriculture) consider as major prospect of the sector (Dayanandan, 2015). Basically, the country's policy for agriculture and rural development can be the first prospect to improve any agricultural sub sectors. Agriculture led industrialization policy creates the fertile ground for the development of the sector. This is general opportunity to develop beekeeping sector all over the country but there is specific opportunities from the region to region (Dayanandan, 2015). Therefore, these opportunities create favorable condition for this sub sector in the country.

CONCLUSIONS

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 products obtained from the subsector were still low as compared to the potential of the country. Like all living animals, honey bees were attacked with disease, parasites, pests, Pesticides & herbicides application, shortage of bee forage and predators endangering their health and life. These impose honey bees to serious problem on honey bee production and productivity. Honey bee colony number is increases year after year due to the high demand for their products. Generally the country had good potential of honey production with increasing trend of expansion. The honey sector is one of the few sectors that had the most inclusive ability to achieve transformation and growth across all categories of rural households through increasing the income of the rural people. This is because of its large resource base and low barriers to entry. However, improving honey bee production techniques is important for sustainable beekeeping practice in the country. Basically, the country's policy for agriculture and rural development can be the first prospect to improve any agricultural sub sectors. Agriculture led industrialization policy creates the fertile ground for the development of the sector. This is general prospect to develop beekeeping sector all over the country but there is specific opportunities from the region to region. Therefore, these opportunities create favorable condition for this sub sector in the country.

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