American Journal of Life Sciences
2015; 3(1): 42-46
Published online February 11, 2015 (http://www.sciencepublishinggroup.com/j/ajls)
doi: 10.11648/j.ajls.20150301.18
ISSN: 2328-5702 (Print); ISSN: 2328-5737 (Online)

Honey production and marketing in Ethiopian

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To cite this article:
Gemechis Legesse Yadeta. Honey Production and Marketing in Ethiopian. *American Journal of Life Sciences.* Vol. 3, No. 1, 2015, pp. 42-46. doi: 10.11648/j.ajls.20150301.18

Abstract: The beekeeping subsector has been an integral part of agriculture in Ethiopia. It has been contributing to the household income and poverty alleviation and national economy through export. The country has huge apicultural resources that made it the leading honey and beeswax producer in Africa. Moreover, Ethiopia is a country where apicultural research is being conducted in a coordinated manner under the national agricultural research system. Hence, a lot of information have been gathered on different aspects of the beekeeping. This is a review of various research results that are from published and unpublished papers over a long period of time in the course of the apicultural research. It has been revealed that the country's beekeeping subsector is mainly practiced using traditional basket hives with low productivity. However, attempts by various investigators and development actors showed that both the production and quality can be improved in terms of transforming the beekeeping system, processing and marketing. This review paper also tried to address both the domestic and international honey marketing and identified some of the major challenges that are obstacles to the possible maximization of benefits by producers and the whole national economy.

Keywords: Beekeeping, Ethiopia, Honey, Marketing, Production

1. Introduction

Ethiopia has a longstanding beekeeping practices that has been an integral part of other agricultural activities, where more than one million households keep honeybees [1,2]. Beekeeping subsector is dominantly for small-scale farmers and is contributing significantly to the increment off-farm income and toward poverty reduction in rural areas [3]. Honey is considered as a cash crop and only about 10% of the honey produced in the country is consumed by the beekeeping households [4]. The remaining 90% is sold for income generation [5]. Beeswax was also in the list of Ethiopian agricultural export commodities, though it was only in 2008 that the country got the EU accreditation to export its honey to EU market [6].

The beekeeping subsector is also creating job opportunities in both rural and urban areas [6]. Recently, the Ethiopian government is intensively working on organizing jobless urban and landless rural youth and women to involve in them in bee equipment production and beekeeping activities. A significant number of people are currently engaged in honey and beeswax collection, *"tej"* (honey wine) making, honey and beeswax processing and marketing [3].

In Ethiopia, a lot of research activities had been conducted and data regarding honey production, physical and chemical characterization, processing and value addition and marketing and problems related to marketing are documented. However, the progresses in different aspects of research in honey have not been reviewed and all the available information are found scattered and in inaccessible situation. Therefore, this review work was executed to review the progress of research in production, value addition and marketing of honey.

2. Honey Production in Ethiopia

Ethiopia is known for its tremendous variation of agro-climatic conditions and biodiversity which favored the existence of diversified honeybee flora and huge number of honeybee colonies [2]. It has the largest bee population in Africa with over 10 million bee colonies, out of which about 5 to 7.5 million are estimated to be hived while the remaining exist in the wild [3,7,8]. This makes Ethiopia a leading in Africa and ninth in the world in honey production, respectively. Similarly, it stands first in Africa and third in the world in beeswax production [9].

Traditional beekeeping practice is the major and oldest type, exercised for more than thousands of years in Ethiopia

[1]. It is characterized mainly by forest beekeeping that is common in the forest covered the south and southwest Ethiopia and backyard beekeeping which is practiced in the majority of the country [2]. Honey hunting is also common in few remote west and southwest parts of the country among traditional communities. Traditional beekeeping is mostly practiced with different types of traditional hives that are very much diversified in shape, volume and the materials used depending on the cultural differences and the local materials available for construction [3]. Reports indicate that the colonies in traditional beehives account for about 97% of the total hived honeybee population [8,10,11]. The productivity of traditional hives is extremely low and the average yield is only about 5–8kg/per colony/per annum [3]. However, with this existing practices the annual honey production in the country is increasing and has reached quite higher than 53 thousand tons in 2012 [8,9,10,11,12].

Currently, intermediate or transitional beehives that are either the Kenyan top bar hives or the locally made "chefeka" hives and frame box hives are being highly disseminated to the beekeepers by different GOs and NGOs. However, finance and gaps in operational skills have constrained the adoption of frame beehives by beekeepers [3]. The number of movable frame hives in use until 2009 was estimated to be only 100,843 [13]. The annual average of the honey yield obtained from "chefeka" hive is about 20kg, while that of the frame hive is about 30kg [3]. But, in high potential areas of northern and southwestern parts of the country more than the average yield from well managed colonies is commonly reported (personal communication).

In Ethiopia, there are generally two honey harvesting seasons: the major one that lasts from October to November and the secondary one from April to June. However, in addition to these major harvesting periods, there are many small harvesting periods which depend on the type of flowering plants and rainfall patterns in different agro-ecologies [2], which experienced beekeepers and local people easily associate the harvesting season with the botanical origin of honey in their locality [14].

2.1. Characterization of Ethiopian Honey

Honey from tropical *Apis* species show wider variations in composition [15]. In Ethiopia, where more than 400 plant species are already identified as major honey plants [16], it is expected to have very diversified honey types. An investigation conducted in HBRC and Biochemical laboratory of the Ethiopian Authority of Standardization to characterize honey samples from all over the country indicated that about 63% of 542 honey samples had moisture content < 21%, those from highly humid areas having higher moisture content and those from low humid regions with lower moisture content. Earlier, [17] reported that honey samples collected from the whole country had moisture content ranges between 15.25% and 30.45%, honeys harvested from traditional hives being higher by 1.5–3% than those harvested from modern ones.

More than 95% and 80% of the samples were in the range of standards of total reducing sugar and acidity, respectively. The mineral (ash) content was relatively lower than the standards of many countries. Around 63% of the samples had HMF value below 40mg/kg. About 72% of the samples meet the diastase activity standards set by EU and FAO/WHO (Table 1). The diastase (amylase) activity of honey has a relevance of indicating overheating, as it is heat sensitive [18]. However, recent complaints have come from Ethiopian honey exporters that the majority of their collections have diastase far below than the standards even for fresh and unprocessed honeys. This is an area of further investigations to understand the nature of these honey samples and their origin in terms of enzyme levels.

Table 1. *Comparison between quality state of Ethiopian honeys with the already set national, regional and international standards.*

Country/Organ	Moisture content %	Total reducing sugars %	Sucrose content %	Acidity (meq/kg)	Mineral content %	HMF	Diastase activity in Goethe scale
EU	21	5	5	40	1	40	3-10
FAO/WHO	21-23	65	5-10	40	0.61	80	3-10
Spain	22.5	70	3	5	0.6	-	
Canada	20	60	8	-	0.25	-	
Latin America Codex	20	-	8	54	0.8	-	
Argentina	18	-	8	54	0.4	40	
Mexico	-	63.9	9	8-52	0.25	-	
Test samples							
range	15-32	59-77	0.01-13	17-95	0.01-1.16	0.96-96	1.5-21.4
mean	20.6	65.6	3.6	39.9	0.23	32.4	6.3

Source: [19] with the last column modification after [18]

3. Processing and Marketing of Honey

3.1. Honey Processing

Many tropical countries have successfully processed and marketed crude honeys using producers, cooperatives and small-scale processors [18]. Processing crude honey has been also proved in improving honey quality and better utilization of resources. It is possible, even honey properly harvested from traditional and transitional hive, to process and market to produce a better quality table honey, since a traditional hive honey is a good quality as far as it is in the hive [20]. The inferior quality of honey comes from the only mishandling of the product starting from harvesting through

storage to marketing.

One of the important steps in honey processing is a preparation of pure honey free from beeswax debris and other non honey impurities. A study conducted at HBRC, using 54 crude honey samples, each weighing 5kg, collected from farm gates and local markets in high production areas: Wollega and Jimma areas in different honey harvesting seasons during 2004 and 2005. Honey samples from "*Gojjam Berenda*" and supermarkets in Addis Ababa were also included as different price indicators for both crude and table honeys. The study indicated that the percentage of pure honey obtained from crude honey varied from 34.4% to 95.0% with a mean of 73.15% which depends on the amount of beeswax found in the honey, the age of the honey comb and its pollen content and other foreign materials. This is slightly higher than what [21] reported that recovery of 30 to 60% pure honey from crude honey. Hence, it is possible to prepare pure and strained table honey from crude honey harvested from traditional and transitional hives. The study also revealed about 35% net profit could be obtained from sell of pure honey and pure beeswax after processing crude honey into pure honey and pure beeswax.

Locally processed and packed table honeys mostly suffer from granulation and problems associated with granulation like: coarse crystallization, different layer formation, fermentation and the resulting gas bubble production (Nuru, unpublished data). Crystallized honey ferments more readily than liquid honey, which is because when dextrose crystals are formed in the honey the liquid phase has higher water content than the entire honey had when it was uniformly liquid [22]. Hence, honey in the uniformly liquid form is safer from fermentation by sugar tolerant yeasts [18]. Moreover, most local people also associate coarse honey crystals with adulteration of honey with table sugar. For best consumer appeals mostly the honey should be in a clear liquid form [18; Nuru, unpublished data]).

A study conducted in HBRC to retard the granulation/ crystallization of table honey and make it stay longer in liquid form indicated that storing temperature is an important factor among others (Nuru, unpublished data). Well drained and strained honey samples kept in refrigerator (4^{o}C) and cold room which is not directly exposed to sunlight with internal temperature of 10–15^{o}C for 10, 20, 30 and 40 days, then brought to room temperature and kept on the same shelf under the same environmental conditions stayed in liquid state longer than samples kept at normal room temperature. However, honey has to be kept in cold room for more than 20 days as samples kept in a cold room only for 10 days crystallized in 87– 102 days, similar to those kept at room temperature. Those honey samples kept for 20- 40 days in the cold room and for 10- 40 days in refrigerator showed a tendency to granulate very slowly, varying from 109 days to more than two and half years. Generally, it can be generalized that these storage situations can retard granulation of honey for 6–12 months as far as the honey is well strained.

The visual attractiveness of honey to consumers can be improved by facilitating rapid fine crystallization process and a term creamed (or spun) applies to honey processed in such away [23]. Finely granulated honey is preferable by many consumers also for its manageability in table since it is easy to spread on bread[18]. Therefore, in conditions where granulation is unavoidable it is better to process the honey in to creamed form. Rapid crystallization can be achieved by "seeding" cool liquid honey with 5% to 15% of a starter of finely granulated honey obtained in a previously controlled process [23].

A study conducted in HBRC to prepare finely and uniformly granulated table honey of three widely produced honey types (*Schiffleria abyssinica*, *Guizotia scabra* and *Croton macrostacheys*) indicated that all the honey samples treated with 5%, 10%, 15% starter nuclei by weight and kept in the temperatures between 14^{o}C and 16^{o}C showed rapid crystallization. However, there were variations in degree of uniformity and texture of the crystals based on the amount of starter nuclei added. For honeys of *S. abyssinica* and *C. macrostacheys*, very fine and uniform crystallization was observed for samples mixed with $\geq$10% starter nuclei at 14^{o}C and 16^{o}C. However, very fine and uniform crystallization of honey of *G. scabra* was observed for samples mixed with $\geq$5% starter crystal nuclei and placed in the above temperatures. Therefore, placing the samples in the range of temperatures (14^{o}C and 16^{o}C) was equally suitable for formation of rapid crystallization of these honey types after mixing with 5%, 10% and 15% starter crystal nuclei. However, moisture content varies between 19% and 20% of all honey samples didn't affect fine granulation.

3.2. Honey Marketing

In Ethiopian, only about 10% of the honey produced in the country is consumed by the beekeeping households[4]. The remaining 90% is sold for income generation and of this amount, it is estimated that 80% is used for *tej* brewing [5]. According to [6], domestic honey consumption is increasing due to highly increasing demand for *tej*, increased consumption of processed table honey in most urban areas and increased demand for honey in the local industries.

The domestic honey market starts at the smallholder beekeepers level, who majorly sell crude honey to collectors in the nearest town/village markets [24, 25]. Therefore, the producers are price takers. The collectors mainly pass the honey to the whole sellers in big cities and towns, though a significant amount of honey they collect also goes to local *tej* brewers, processors and other consumers [6, 24, 25]. The whole sellers are largely situated in cities and big towns and they distribute the honey they get from collectors to retailers, *tej* brewers, processors and consumers. In some areas, beekeepers form producing and marketing cooperatives to cope with the market challenge they face. The cooperatives collect crude honey from their members and sell the semi-processed honey to processing companies and other intermediaries who buy in bulk and retail. However, in many cases the cooperatives lack proper collection, storage and transportation facilities and hence compromise the quality of

the honey. They also have low business concept (market information gathering and analysis, pricing, promotion, etc) to be competitive [25].

The whole domestic honey market lacks proper structure and legality. It is of lengthy chain of actors that widens gap for the access of producers to bigger and better paying markets. So, the beekeepers complain the business as not rewarding and even lacking the market for their product, while the consumers see the ever increasing price of honey as unfair. Moreover, the market faces challenges like smuggling that pushes the legal actors out of market. In many cases, adulteration of honey has been a frustrating factor for both the producers and legal buyers and sellers as the traceability and accountability is hardly possible.

It is not only the local honey market but also the export is increasing. The total volume of exported honey between 2000 and 2008 has been increasing recently; 1.5 tons in 2000, 275 tons in 2010 and more than 730 tons in 2012 [6, 26, 27]. And the export trade of Ethiopian honey has reached more than 2.43 million USD [27]. The involvement of honey and beeswax processing companies is also an important factor for the increased export volume. In 2008, 17 honey and beeswax processing companies were registered [6]. The major importers of Ethiopian honey include Sudan, Norway, UK, Saudi Arabia, Kuwait, Yemen and other European countries and USA [26, 27]. The honey price in the domestic market is mostly higher than the international honey price which makes honey export less profitable in Ethiopia [6]. Many of these companies have dropped out of the international honey trade and are now targeting the local markets which are still attractive (personal communication).

4. Conclusions

Ethiopia has huge potential for honey production which is clearly observed in the last few years with significant increment, even though the subsector is still practicing with traditional low productive systems. Research and extension made so far have tried to improve this scenario in the country. Various investigations in particular have identified the problems in the production and marketing of the Ethiopian honey industry. It is apparent that a lot more is to be done in improving the quality of the honey produced. Again, the market needs fundamental change in its structure and functioning systems to address the accessibility of the better price market for the producers and better quality honey for a fair price for the consumers. Moreover, the legality issue in the honey market needs thorough consideration to tackle problems like smuggling and adulteration so that the country can benefit from the expanding export market.

Acknowledgment

I would like to acknowledge all the previous investigators who produced valuable research articles and availed for this review paper.

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