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Assessment of Honey Bee Production System in Horro District of Horro Guduru Wollega Zone of Oromiya Regional State

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Abstract
This study was conducted in Horro district of Horro Guduru Wollega Zone of Oromiya Regional state. In the study area 3.3% of respondents participating in honey production before 20 years ago, which increase to 23.3% now a day. Among those 81.7% of the respondents were starting honey production by traditional which modified to intermediate recently. Hives were constructed from locally available material. After construction is completed, hives are bound with straw to protect from sun heat, cold and rain. The two ends of the hives were closed with plank; one of the planks is provided with fixed and the other is flight entrance. Then internal surfaces of the hives are plastered with fresh cow dung and leave to dry for 1-2 days. The removable, an entrance hole is opening through which beekeepers can remove combs during harvesting. Finally, the hive is fumigated (smoked) for 20-25 minutes with dry cow dung and split wood of Juniperus or Olea species. In this study, accurately determining honey yields proved is difficult exercise, as most of beekeepers were unable to quantify correctly in any weighing scale. Nevertheless, by estimation, per hive per harvesting was ranging from 0.4±0.6kg up to 2.6±0.6kg of crude honey for Rifenti Cabir which is very low and 1.6±0.68kg up to 24.0±0.68kg of crude honey which is high for Doyo Bariso kebeles of the study area. Honeybee disease in the study area was not as much observable. However hamagot, spiders, ants, birds, and monkeys with the percent of 97.6, 61.7, 51.7, 48.3 and 38.3 were major predators in the study area respectively. Hamagots and spiders significantly affect the hive.
Keywords: diseases, forage, hive, honey,

1. INTRODUCTION

Ethiopia is endowed with diverse agro-climatic condition that favors the existence of large and unique biodiversity both in plants and animals including honeybee subspecies. The wide variety of vegetation and other conducive environmental conditions that make the country highly favorable for honeybees were dominate (Amssalu, 2004). Beekeeping in Ethiopia has been a tradition since long before other farming systems practiced. It is a very long-standing and deep-rooted practice in the rural communities of the country. Accordingly, the result of the survey revealed that a total of about 5.15 million hives is estimated to be found in the rural sedentary areas of the country and about 39.7 million kilograms of honey is produced, which is the greater portion harvested from traditional hives (CSA, 2009).

Beekeeping is a major integral component in agricultural economy of the country and produce much more than food through maintenance of biodiversity (Jones, 1999). The best known primary products of beekeeping are honey and wax, but pollen, propolis, royal jelly, venom, queens, bees and their larvae are also marketable bee products. While most of these products can be consumed or used in the state in which they were produced by the bees, there are many additional uses where these products form only a part of all the ingredients of another product. From the primary product of beekeeping, honey is the most important both from a quantitative and an economic point of view.

Despite the long tradition of beekeeping in Ethiopia, the level of beekeeping still remains in traditional system with its various limitations (Gezahegne, 2001) and the contribution of beekeeping for gross domestic product has never been commensurated with the huge numbers of honeybee colonies and the country's potentiality for beekeeping. Productivity of the subsector 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 subsector as expected (Nuru, 2002). Deforestation is one of the major problems which devastate the pollen and nectar sources of the honeybees (Tilahun, 2003).

Consequently, it is believed that this loss of vegetation has and will lead to decline in honeybee population and honey production and thus calls for protection, wise use and rehabilitation of natural resources for sustainable honey production. Drought, decline in vegetation coverage and subsequent changes in natural environments, pests and predators, and indiscriminate applications of chemicals are causes for the low production of honeybee products in the country (Tilahun, 2003).

Horro Woreda is among the potential areas for honey production found in the Horro Guduru Wollega zone of Oromiya region. It is specially suggested because, in the study areas are covered with various types of trees, shrubs, bushes, and field flowers that make the districts still potential for beekeeping. To date, there is no compiled and published information on honey bee production systems, associated constraints and opportunities of beekeeping in the study area. Thus, this study was, therefore, designed to assess the overall honeybee production

system in the study area with the following specific objectives: To assess honeybee production practices in Horro Woreda of H/G/W Zone and To identify major constraints and potentials of honeybee production in the area

2. MATERIALS AND METHODS

2.1. Description of the Study Area

The study was conducted in Horro district of Horro Gudru Wollega Zone of Oromiya Regional state. The District town Shambu is located 310 km west of Addis Ababa. The district has 23 peasant associations out of which dega (highland), woinadega (mid-highland) and kola (lowland) constitutes 43%, 56% and 1%, respectively. With the average annual rainfall of 1650 mm and the annual minimum and maximum temperatures of 18^{o}C and 27^{o}C, respectively (unpublished data). Livestock production is one of the major economic bases and the district has an estimate of 71,933 204,968 114,603 and 357,897, cattle, sheep, and goat and poultry population, respectively. The district also has 111,746 beehives (CSA, 2009).

2.2. Sampling Techniques and Sample Size

The survey was conducted in 10 different Kebeles of the woreda. Purposive sampling procedure was employed to select the peasant associations based on their agro-ecological location those participating in honey production. From these, four and sex peasant associations were randomly taken from the dega and woinadega areas, respectively.

From each selected peasant association twelve beekeeping households with a total of 120 households were selected purposefully based on their activity in extension service and experience in keeping honeybees in order to obtain reliable information for the questions asked. The experience and activity in extension service in beekeeping were identified by the help of development agents of the respective peasant association. Single household respondent, from the household who is responsible for keeping the bees, was used as sampling unit in this study.

2.3. Methods of Data Collection

primary data were collected from sample respondents through a semi-structured questionnaire, which was designed to generate data on household profiles (sex, age, family size, education level, livestock and crop production), honeybee production systems (number and types of hives used, type of beekeeping equipment used), honey flow season, trend of honey yield and price of honey over years, farmers' indigenous knowledge on beekeeping, potentials and constraints of apiculture and post-harvest handling of honey in the study area. In addition to this, primary data was collected using informal group discussions and by interviewing key informants. Pre- testing of the questionnaire and record sheets were made as a pilot survey and on the basis of information obtained at this stage; modifications were made on the questionnaire. The collection of information was made at household level. Secondary data were used from reports of published and unpublished materials.

2.4. Statistical Analysis

Data collected through survey were analyzed by descriptive statistics using SPSS software version 16.0.

3. RESULTS AND DISCUSSION

This section provides an overview of the socio-economic circumstances of beekeepers in Horro woreda based on the questionnaire survey. The questionnaire approach was useful as it contained many open-ended questions that allowed the respondents to express their opinions on issues. In this study the results are presented and discussed more specifically and entirely to the situation of sample households and are presented

3.1. Honeybee Production Systems

In this study, beekeeping production systems identification was done based on the types of technology and management practices used by the beekeepers. According to the respondents some of the societies in the study area were participating in honey production. The survey way of data collection was focused on those respondents participating on the activity of honey production, even if the rate of participation varies. The rate of participation was increasing from 3.3% before 20 years to 23.3% now a day due to the awareness of the respondents by development agent of the woreda.

However 81.7% of the respondents were starting honey production by traditional and modified to the intermediate one now a day. But modern one is not fairly distributed in the respondent's area still. This is the indication of using the indigenous knowledge in the study area.

3.1.1. Beekeepers' Indigenous Knowledge

Indigenous knowledge of beekeeping, like other culture, transferred from generation to generation. Beekeepers have knowledge of plants utilized by bees, their flowering times, and poisonous plants to bees. Based on this the beekeepers can differentiate the beekeeping calendar in their area. According to the respondents they cut the queens

feather to control swarming to avoid successive division of the colony. They also control pests and predators from attacking their colony. The Alberta Agriculture, Food, and Rural Development publication Commercial Honey Industry states: "Only through hands-on experience can new entrants gain the basic skills required for opening hives, removing frames, identifying queens, recognizing the difference between brood and honey capping, and recognizing the difference between honey and pollen in a cell" (Dey, 2001).

3.1.2. Traditional hive construction

Beekeepers of the area look for hive construction locally available materials like "soyoma", Mexi and fiber like structures called "hincini". The upper lateral of "meti" is cut by axe or power- saw into logs of desired thickness and length. Africa has the oldest tradition of beekeeping in the tropical region. Hives are made of locally available materials and were imported goods are certainly not required (FAO 1986; Bradbear, 2003). Using the same tools, the logs are then split into two, lengthwise. The inner part of each half is etched out with an axe and a special chisel, leaving a thick outer wall. When the two halves tie together by vines, rope or wire, the result is that over laying the two separate trough form a hollow cylinder. Usually the hives are made large enough to contain the bees and the entire comb they might build in a good year. The hives used to bait swarm by smearing the inner sides with hot beeswax and herbal swarm attractants.

The mean length of hive is about 1m and the mean diameter is about 30.0cm. After the construction is completed, the hive is dried for 3-5 days. Then the internal and external surfaces of the hives are plastered with fresh cow dung and grasses respectively and leave to dry for 1-2 days. These hives are bound with straw/grass to protect them from sun heat, cold and rain. Then, the two ends of the hives were closed with plank; one of the planks is provided with fixed. The other is removable; with entrance holes and it is the opening through which the beekeepers can remove the combs during harvesting. Finally, the hive is fumigated (smoked) for 20-25 minutes with dry cow dung, leaves, barks and split wood of Juniperus or Olea species.

Usually, the hives are smeared with wax and sweep up with some aromatic tree leaves to attract swarms. This preparation is done as near to swarming time as possible. Swarming usually takes place at the beginning of the honey flow periods. The hive is hung or fixed in a tree and left to be occupied with swarm. Hives used for swarm catching were usually small, because the beekeeper wanted to encourage swarms to populate his empty hive. If a hive has not been occupied during the first swarming season, the baiting should be renewed at the beginning of the next swarming season.

Hives are suspended high above the ground for a number of reasons, and according to FAO (1986) and Edessa (2002), it provides a cool, shady area for the colony, it protects the colony from fire and floods, it prevents attack by ants, honey badgers and other wild animals, it seems easier for swarms to locate and enter hives hang in trees and bees in such hives cause less disturbance to pedestrians and farming activities. In addition, no great quantity of drone comb develops; as a result the maximum amount of worker brood is produced (Smith, 1960).

3.2. Honey production

The honey production in different kebeles of horro woreda was traditional, transitional and modern; even if the rate of distribution and their use varies from kebele to kebele even in the same kebeles. However the availability of traditional hive was dominating due to made from locally available materials, local done without the special experts and need less attention than the modern one.

In this study, accurately determining honey production and yields proved to be a difficult exercise, as most of beekeepers were unable to quantify correctly the harvestings in kilogram or any other weighing scale. Nevertheless, based on beekeepers estimate, the number of kilograms taken per hive per harvesting was ranging from 0.4±0.6kg up to 2.6±0.6kg of crude honey for Rifenti Cabir which is very low among the responds kebele and 1.6±0.68kg up to 24.0±0.68kg of crude honey which is high for Doyo Bariso kebeles of the study area. The averagely activity in Didibe kistana, Akaji sabat and Ashiya Dosho were similar with minimum and maximum crude honey production of 1.0kg and 4.8kg respectively. This similarity exists between the kebeles in woreda mainly due to forest beekeeping with extensive management practice in the kebeles similarity. Slight differences between kebeles were due to supplementation of feeding and watering practices of honeybees during the dearth periods. Based on this study, the average honey yields per hive per colony in Doyo Bariso kebele of the wereda, were greater than the National average of 5kg for traditional (Gezahegne, 2001a; EARO, 2000). In general the overall products in the respondent area were increasing from year to year none significantly ($P > 0.071$). However the idea changes were done by development agents of the kebeles to participate in modern hive preparation. Generally, the proportion of honey produced from intermediate hives is relatively small because of few participants. In this study functional movable frame hives were very few in wereda.

Most of the colonies are not survive after one harvesting season, so expected honey to be produced will be low amount for the next season. Concerning the colony sale more of the respondents (51.7%) were not know from where the colonies come and chancily they gate, where as 40% of the respondents answer as no sale of the colony. More experienced and somewhat those have education and experience of bee catching were selling (8.3%) the colony with little price (91.7%), even consider as a gift (8.3%). Based on these criteria two honeybee

production systems were identified in the study areas. Even though the product from the transitional and modern hive is more quality and quantity the availability of both hives in the area were low. This indicates that the understanding of the society on the transitional and modern hive is low and the indication on the transitional hive was high in number at the beginning but low product was harvested. The profitability of beekeeping is governed by the honey yield per hive, together with labour costs, the selling price of honey and other hive products, and other factors. The honey productivity of an area, as measured by the average honey yield per hive, influences the number of colonies of bees on that particular area (Crane, 1990).

This indication shows the management of the society on the transitional hive were low that leads to participate on using this hive. After well awareness of the development agents the participant becomes have the hive again and gate somewhat good products later on at the year of 2003. While hive making peoples of the area were smoking the traditional hive by locally available tree cover like Sombo, Ejersa after making the traditional hive from locally available materials. Though it's made up of locally available materials people give little attention to the hive. For honey production 63.7% of the participants were hanging on trees near homes and 36.3 % of them were put under the eaves of the house.

The challenging things for having the transitional and modern hive were lack of awareness and initial capital limitation because of its cost. From this point of view fewer people (3.3%) were participating in honey production with modern hive, even if it has longer (5 years) performing than the traditional one. As many of the respondents participating on the traditional hive, most of them (95%) were empty, among these 33.3% after harvesting, 11.7% lack of feed and 10% lack of management of the hive. This occurs due to lack of consideration to bee feed during harvesting the honey, seasonality of the flower for honey bee feed. The other one is site preference for the hive, most of them (93.4%) hanging on the tree it is difficult to examine internally or externally to understand what lack with the bees in the hive.

3.3. Honey Harvesting and Processing Procedures

The recommended time for harvesting honey is when bees ripened and sealed the honey in the combs. Beekeepers in the study area have devised generally accepted alternative methods to determine when to harvest honey. 50% of those interviewed consider the length of time elapsed since key nectar plants bloomed expecting that by the time all flowers have withered; bees have had sufficient time to ripen honey and seal it. Other respondents interpreted the presence of bees clustering at hive entrance to indicate storage of large quantities of honey. The other beekeepers determined the right time to harvest honey by especial flavor and aroma of honey smell detected near by the hives and the others looking out for time when experienced beekeepers start harvesting the crop.

Generally, the environment and climate were found to be important issues that determine the harvesting times in Woredas. According to the respondents, the presence of rainfall delays the harvesting time of the study areas because during rainy periods the beekeepers do not open their hive.

3.4. Methods of harvesting

Honey harvesting takes place at night and the interviewed beekeepers described that beekeeping by necessity is a group activity. The concerned beekeeper is assisted by at least one member of his household usually son, friend or neighbor. Although beekeeping in the study area is almost exclusively a male occupation, one may occasionally encounter a woman who keep bees or help a family member to harvest honey. This is, however, rare and they tend to be divorced or the widows of beekeepers mostly. The process of harvesting is very intensive and tedious.

Most beekeepers said that they burned wood or dried cow dung to disperse and calm down the bees before removing the combs. Then, both the honey and the brood combs that contain eggs, larvae and pollen are harvested using a long, flat knife from the inner sides of the upper part of the hive. All the harvested combs are placed into any available container as long as it is clean and has a cover. Any comb pulled out of the hive cannot be returned back and often the empty combs, which can be used to prepare wax, are just thrown away because nobody knows how to use it.

The beekeeper proceeds to harvest from other hives on the same night wherever ripened honey is available and as long as they have sufficient aides to assist in transporting the harvested yield back to the home. At the end of the task the two splits of the hive are assembled together and either kept in the houses for the next season or re-hanged in the trees for the whole year. The honey combs brought home and crushed by hands to get the mixture of honey, beeswax, pollen and sometimes brood. Generally, beekeeping in the woreda is practiced uneconomically in traditional hives of 'tree apiary'. The product being obtained by severely disturbing the honeybee colonies, after which they was either killed or they abscond so that the colony cannot maintain for the next harvest.

To harvest honey the beekeeper cut away the combs one by one from the back, which is relatively free from bees and pull out the combs by hand. Harvested combs are placed into a container and cover with a lid. By experienced beekeepers, combs that are found bearing brood and unriped honey are left intact for bees to use. Since many of the hives were “beyond the reach of a man’s arm” and only one end is worked at a time, some combs would be left intact without being harvested so that some combs, broods, bees and the queen are not

destroyed. Therefore, in this type of hives, the colony survived for the next seasons (FAO, 1986).

3.5. Factors hinder honey production

Though that many factors mentioned the status of hive production were increasing, but the expected honey were not harvested from available hives. From this point of view predator's affects honey production varies according to the environment and seasonality of the condition. So the respondents gave rank depending on their risk factors in the area. Depending on the respondent's idea hamagot, spiders, ants, birds, and monkeys with 97.6%, 61.7%, 51.7%, 48.3% and 38.3% were major predators in available in the study area respectively. The rate of affecting the hive were also vary Hamagots and spiders significantly affect the hive, Even if there is wide distribution of insects and pests in the area the rate of empty hive were low (10%) of the respondents have empty hive. This is due to lack of proper management after harvesting in traditional hive.

According to the respondents idea the status of honey production were increasing with some addition of transitional and modern one. This is due to the hard work of the development agents in the kebeles and somewhat extension package given by woreda to the study area. However development agent awaring the society, bottle neck of bee production were 2, 4, D., chemical application as anti weeds.

The estimate honey losses due to the application of chemicals like 2, 4, D., as anti weeds were low according to the respondent's idea. But the rate of honey loss due to this was variable from kebele to kebeles. From this point of view loss of honey in the kebele in birr 180±115.98, 150±295.62, 40±70.62 in Kombolcha canco, Didibe kistana and Rifenti cabir respectively. Therefore the loss of honey in different kebele is significant (P> 0.021) and non significant within the group. Honeybee diseases availability in the study area were not as much observable 81.7% of the respondents were not face any diseases were as the remaining 18.3 face with honey bee diseases in their apiary.

3.5.1. Migratory beekeeping

Migrating of honeybee colonies is common during scarcity of feed. Then, the colonies are placed in the beekeepers 'relatives' backyard or on trees near the homestead. Migratory beekeeping is the most intensive of all forms of honey production. By careful study of the vegetation and climate and the resultant honey flows in different regions, the migratory beekeeper can collect crop after crop, in some countries almost the whole year round (Smith, 1960).

3.5.2. Absconding

The most common causes of absconding mentioned by the respondents were poor harvesting techniques (50.85%) and invasion of hives by hamagot, spiders, ants, birds, and monkeys with 97.6%, 61.7%, 51.7%, 48.3% and 38.3% were major predators available in the study area respectively depending on their risk factors in the area. The rate of affecting the hive were also vary Hamagots and spiders significantly affect the hive, Even if there is wide distribution of insects and pests in the area, the rate of empty hive were low (10%). This is due to the lack of proper management after harvesting in traditional hive.

4. CONCLUSION AND RECOMMENDATION

In this study the farmers having small plot of land were engaged in beekeeping activities. Using indigenous knowledge most of the respondent's participating in traditional honey production. Most of beekeepers were unable to quantify correctly the harvestings in kilogram or any other weighing scale. Respondents were forced to do hive from year to years in order to have honey hive at hand. The challenging things for having the transitional and modern hive were due to lack of awareness and initial capital limitation. Major limiting honey production factor were seasonality of bee forage, long distance of water availability which leads to migration and absconding of honey bee to find the available bee forage and water. hamagot, spiders, ants, birds, and monkeys with were major predators available in the study area due to the lack of proper management after harvesting.

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BIOGRAPHICAL SKETCH

The author was born in 1986 in Guduru Woreda of Horro Guduru Wollega Administrative Zone of Oromiya Region at a place called Kitessa Gera.

He joined Jimma University College of Agriculture in September 2004 and graduated with B.Sc. Degree in Animal Science (Animal production and health) in June, 2007.

Thereafter, he was employed in the private college in teaching of veterinary at Nekemte town of West Oromiya Regional state of Ethiopia. He tests bitter leaves by board committee of college. At this period he was confused in preferring to teach or to learn the option raised for him from committee. Know at the moment the outer has two publications.

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