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Review on Beekeeping System, Constraints, and Opportunities in Ethiopia

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ABSTRACT

The purpose of this study is to review Ethiopia's beekeeping system, including its restrictions and prospects. Africa is home to a diverse range of wild honeybee species. Ethiopia is one of the continent's countries with the highest honey production potential. Ethiopia has the most diversified flora and fauna in Africa due to its varying ecological and climatic circumstances. Beekeeping is one of the most significant sectors that contribute to improving people's livelihoods in many countries. Beekeeping provides nutritional, income-generating, and environmental security to rural populations on a family level. It also contributes to increased agricultural output through honeybee pollination. However, the Ethiopian beekeeping system faces numerous challenges, including a lack of bee equipment, pests, and predators, a lack of skilled manpower and awareness, a high rate of deforestation, a lack of government intervention, other honeybee swarming and absconding behavior, a high rate of deforestation, and agrochemical issues. The biggest challenges are the existence of pests and predators, as well as a shortage of bee equipment. Despite this, numerous prospects are available, including increasing marketing demand, government advocacy initiatives, improved diversity of honey bee colonies, increased hive product, crop pollination, and job creation. A comprehensive set of enhanced beekeeping technology, as well as suitable practical skill training, should be implemented.

Keywords: Beekeeping, Constraints, Ethiopia, Opportunities.

INTRODUCTION

Ethiopia is among the nations on the continent with the greatest potential for honey production. Because of its unique ecological and climatic circumstances, Ethiopia has the most diversified flora and fauna in Africa [1].

It is challenging to pinpoint the exact beginning of beekeeping in Ethiopia due to the country's long history, which dates back thousands of years [2]. However, other accounts have established that it began 5000 years ago, and Abyssinia is mentioned in ancient Egyptian hieroglyphs as the source of beeswax and honey. For ages, Abyssinia has been recognized for exporting bee wax, even when other goods were not exportable [3]. Traditional backyard, transitional, traditional forest, and improved beekeeping are the four categories of beekeeping practices in Ethiopia [1].

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Ethiopians have been keeping bees for thousands of years, making it the oldest and most lucrative activity in the country. Almost everywhere in the nation, several million bee colonies are administered using antiquated, conventional beekeeping techniques [2,4].

Ethiopia was the first country to use transitional beekeeping in 1976. It is one of the better beekeeping techniques when compared to traditional ways and is a type of beekeeping activity that lies in the middle of the two [2,5].

Modern beekeeping techniques are crucial to delivering the best honey output for a long period without harming bees as well [6]. The contemporary movable-frame hive is composed of well-constructed rectangular box hives stacked one on top of the other in a layer; the quantity of boxes varies according to the season and the size of the bee population. Ethiopia has seen the introduction of around five varieties of movable frame hives since 1970 [6,7].

It is a significant and essential part of the nation's agricultural economy [7]. Both directly and indirectly, it supports the nation's economy. While its indirect contributions include increased crop output and pollination-based environmental conservation, its direct contributions include the harvesting of honey and hive products like beeswax and bee colonies [8].

Major constraints in the beekeeping sub-sector [6]. Honeybee disease, pests, and predators, poor extension services, lack of coordination between research, extension, and farmers, lack of policy in apiculture, lack of records and current information, low level of technology used, high cost of improved beekeeping technologies, drought and deforestation of natural vegetation, poor post-harvest management of beehive products and marketing constraints, indiscriminate application of agrochemicals and the unfavorable behaviors of bees (aggression, swarming tendency, and absconding behaviors), the lack of skilled manpower and training institutions, lack of training institutions and the lack of apiculture policies [1,8].

However, these issues might not be equally urgent in every location and might not be a hindrance in every region of the nation [9]. Thus, it is necessary to describe the limitations in their various locations to deal with a variety of natural stressors and adversaries, such as weather, natural catastrophes, pests, predators, parasites, and illnesse [1,6,10].

The creation of suitable development strategies for the appropriate utilization of the available potential in sustainable ways depends critically on having comprehensive knowledge of the available resources and recognizing the obstacles [11,12]. The value of the products produced, such as honey, bee wax, queens, and bee colonies, as well as other items like pollen, royal jelly, bee venom, and propolis used in cosmetics and medicine, constitute the direct contribution of beekeeping. There are many reviews published on bee production its challenges and opportunities, but there are few to organize on a single paper. Therefore, the objective was to review the beekeeping system, constraints, and opportunities in Ethiopia.

BEEKEEPING SYSTEM IN ETHIOPIA

Beekeeping has been practiced in Ethiopia for a very long time, predating other farming techniques [13]. Despite being one of the most significant and ancient farming practices in the nation, no records exist that can be used to pinpoint the exact beginnings of beekeeping. However, Abyssinia, the historic name for Ethiopia, is mentioned in the Hieroglyphs of ancient Egypt as a source of honey and beeswax. For ages, Abyssinia was recognized for exporting beeswax to Egypt, even while other goods were not. Ethiopia may have the oldest beekeeping tradition in the world [14,15].

Traditional beekeeping System

In Ethiopia, beekeeping has a long history and is an essential aspect of the farming families' way of life [12]. Depending on their volume and the materials they are composed of, the nation has documented over ten different kinds of traditional hives [13]. Clay, straw, bamboo, fake banana leaves, tree bark, logs, animal dung, grasses, wicker, and other inexpensive, locally accessible materials are used to make them [15]. The majority of conventionally built fixed bee hives are cylindrical, with a single chamber fixed comb and dimensions of roughly 1-1.5 meters in length and 30-50 cm in breadth. Only by breaking or cutting out the honeycombs can the honey be extracted because the combs (pollen, brood, and honeycombs) are fastened on the hive body's roof [13].

Traditional forest beekeeping system

To capture swarms, hives are positioned on extremely tall trees in the forest [16]. It is frequently practiced in regions of the nation with forests and a high concentration of honeybees [17]. The benefit of keeping bees in forests is that they can obtain a variety of feed plants nearby and do not hurt humans or domestic animals [15]. Its drawbacks include a lack of careful monitoring and harm to the honeybee colony when the beekeeper lowers the hive from the tree during the honey harvesting season [18]. Additionally, climbing large trees at night is risky for beekeepers [10].

Figure 1. Traditional forest beekeeping system [16].

Traditional Backyard Beekeeping System

Backyard beekeeping is being undertaken in the vicinity of homestead areas to keep the honeybees safe [18]. One benefit of these methods is that they don't require sophisticated beekeeping equipment or experienced labor and construction is quite easy [9]. However, this practice's drawbacks include the inconvenience of doing internal feeding and examination. In certain regions of the nation, swarming occurs due to hives that are too small [15]. According to Tesfaye et al. [18], traditional home beekeeping was widespread throughout most of Ethiopia, especially in the Bale zone in the southeast, and was managed better than forest beekeeping.

Figure 2. Traditional backyard beekeeping system [18].

Transitional beehive beekeeping system

In between traditional and frame hives are transitional hives, one of the contemporary hive varieties being pushed in the nation. It is among the more advanced beekeeping techniques [5]. Tanzania Top Bar Hive (TTBH) and Kenya Top Bar Hive (KTBH) are the two varieties of hives [15]. The hives can be built using mud, wood, or materials that are readily available in the area. Honeybees attach their combs to the 27–30 top bars that each hive has. The width and length of the top bars are 3.2 cm and 48.3 cm, respectively [19].

Transitional (intermediate) beekeeping has several benefits, including ease of opening and speed, the ability to guide bees into creating parallel combs by following the line of the top bars, the ease of removing the top bars, which allows beekeepers to work quickly, the ease of constructing the top bars compared to frames, the ability to harvest honeycombs from the hive without disturbing combs that contain broods, and the ability to suspend the hive with wires or ropes to provide pest protection [12,19]. In addition to producing more honey than regular hives, transitional hives offer a way to track honey maturity, allowing for the best possible harvest period [13,14].

The drawbacks of transitional beekeeping include the fact that top bar hives are costlier than conventional hives and that combs hanging from the top bars are more likely to fall off than combs built inside frames [12].

Modern Beekeeping System

There are various kinds of frame hives used in modern hive beekeeping practices [20]. The most prevalent bees in the nation are the Zandar and Langstroth varieties. Rare are foam hives, didn't, and revised Zandar. These hives have varying numbers of frames and sizes [20]. The most prevalent kind of hive in Ethiopia is the kind. A better beekeeping hive has an inner and outer cover, a super (honey chamber), and a Zandar Brood chamber [22].

One advantage of the upgraded hive over the others is that it yields honey of superior quality and quantity [1]. Upgraded hives also have the advantage of preventing swarming by moving bees from one place to another in pursuit of pollination services and honeybee flowers [19,21]. However, its disadvantages are that it requires professional labor, the equipment is fairly costly, and it necessitates exceedingly precise precautions [13].

Figure 3. Modern beekeeping system [1].

CONSTRAINTS OF BEEKEEPING

Lack of Bee Equipment

Insufficient equipment was the biggest obstacle to beekeeping [10]. Insufficient bee equipment (such as modern hives, casting molds, and frame wires), accessories for bee equipment, pesticide poisoning of bees, and inadequate honey processing supplies [9,14]. Because some bee equipment, such as modern hives, wax printers, and honey extractors, are so costly, farmers may not be able to purchase and utilize them [10].

Consequently, there is a lack of suitable technology for manufacturing, gathering, processing, packaging, and storing. Better bee equipment is out of reach for farmers, and even for beekeepers who can afford it, it is not readily available. Due to their lack of resources, the majority of farmers were unable to purchase and employ contemporary bee technology that would increase honey yield [21].

Pests and Predators

Ethiopia is a sub-tropical country, therefore the environment is not only conducive to bees but also to several honey bee pests and predators that affect honey bee existence [23]. The main issues with beekeeping are the honeybee enemies that reduce honey production, including ants, honey badgers, birds, and small hive beetles. Within hours or even overnight, pests and predators seriously and catastrophically harm honey bee colonies [10-12].

Wax moths, spiders, ants, bee-eater birds, honey badgers, and beetles are the main bee pests and predators in the district, according to a study by Sahle et al. [21]. These pests and predators pose the biggest threats to the growth of beekeeping. The study by Gidey et al. [17], which found that absconding, predators, and bee pests are the main obstacles affecting the honey subsector in northern Ethiopia, also corroborated the findings.

Lack of Skilled Man Power and Awareness

The majority of beekeepers are not trained in proper beekeeping techniques, which is one of the professions that has suffered and continues to suffer from a shortage of experienced personnel [10,24]. Ignorance of the product, resources, and processing abilities, as well as the absence of a market for beeswax. The product has therefore only been used to grease local food baking materials, with no one else benefitting from it [1].

Furthermore, little is known about how to eliminate and lessen the main risks connected to apiculture, as well as how to handle them when they do occur [11]. Training is scarce, and beekeepers who do own contemporary hives lack the abilities and know-how to properly care for them. Because of this, they often employ subpar extractive harvesting techniques and equipment that are not suitable for this type of hive [25]. Additionally, they rarely provide supplemental feed (flour, sugar syrup, or water) during droughts and are unaware of the current standards for honey quality in export markets [2].

Lack of government intervention

The primary reason beekeepers lack understanding of proper beekeeping techniques is a lack of government participation, as there isn't a single college or university in the nation offering diploma or certificate-level beekeeping courses [21]. The sole organization that offers farmers, extension agents, and specialists fundamental training is the Holeta Bee Research Center. Nevertheless, this falls short of the growing need for skilled labor in the majority of the nation's regions [9].

Honeybee swarming and absconding behavior

Reproductive swarming in honeybee colonies is a common occurrence, according to Shenkute et al. [1], studies conducted in the Kaffa and Shek zones. All beekeepers agreed that controlling reproductive swarming in traditional hives is challenging due to internal inspection. In comparison to the Bench-Maji Zone, the Kaffa and Sheka Zones have a lower honeybee swarming rate. About 85% of the farmers in the research areas stated that selling honeybee colonies is not a regular practice. Swarming is the only colony source because the practice is so old-fashioned. While the remainder obtain their bee colonies from wild nests, over 67% of the respondents obtain their colonies by erecting traditional hives on trees.

High Rate of Deforestation

Deforestation of forest cover for building, fuel, lumber production, and agricultural land expansion is directly linked to the scarcity of bee feed. Especially in the dry season, these lead to a scarcity of bee food [20]. In according to Sahle et al. [21], provided support for this theory. To find bee food during the dry season, the majority of beekeepers in the district have been moving their bee colonies from one location to another. In addition to raising farmers' income, this will result in colony loss due to pests and predators. In many places, good nectar and pollen-producing tree species have been eliminated, making it challenging to sustain bee colonies without food.

Problems of Agrochemical

Pesticides that kill bees and herbicides that damage many plants that are important to bees as pollen and nectar supplies, including Malathion, Sevin, DDT, 2-4, and Acetone, are not harmful to bee colonies [26]. According to a study

by Beyene and Verschuur, [27] the district farmers plant a variety of horticulture crops, including chickpeas, teff, barley, and wheat. They employ chemical sprays, including pesticides and herbicides, to control weeds and pests without taking into account the harm they do to bee colonies, and farmers' chemical spraying is also harming bee feed, such as shrubs and plants [28].

Bee Diseases

Numerous pathogens can target bee populations. These illnesses are caused by bacteria, protozoa, fungi, viruses, and other microorganisms [12]. Additionally, bees and their products are susceptible to a variety of parasites, diseases, and pests. Ethiopia is generally home to chalkbrood, amoeba, nosema, and poisonous plants [29]. The production and productivity of honey bees are severely hampered by these diseases. Melpighamoeba mellificae and Nosema apis are two adult honeybee illnesses that have been investigated and documented, along with their distribution [19].

OPPORTUNITIES OF BEEKEEPING

Government Advocating Program

The government is advocating for a self-contained program that uses locally accessible materials to create modern hives at a cheap cost. It is also attempting to group farmers and connect them with carpenters in the area who create modern bee hives at a low cost [23]. To diversify its export commodities and combat poverty, the government has focused more on the growth of the apiculture subsector [10].

Increased Hive Product

Beekeeping is an essential aspect of the farming communities' way of life in Ethiopia, and it is a widespread practice wherever people have inhabited, except in a few remote regions [23]. According to Beyene and David [30], Ethiopia also likely has the longest history of marketing honey and beeswax among all African nations. According to Gezahegne [31], the direct contribution of beekeeping comprises the value of the products produced, such as honey, bee wax, queens and colonies, and other items like pollen, royal jelly, bee venom, and propolis used in cosmetics and medicine.

Increased diversity of honey bee colony

Numerous local bee hives and appropriate settings with a variety of agroecologies [23]. Over 7000 kinds of flowering plants have been able to flourish in Ethiopia due to the country's agroclimatic conditions, which are characterized by abundant food supply and diversity. This has allowed for the survival of numerous native bee colonies. There are thought to be more than two million bee colonies in the nation's forests and cracks. The country may currently have the highest number of honeybee hives on the land of any African nation [32].

Creating High Marketing Demand

Availability of farmers with traditional knowledge and expertise who are eager to embrace new technologies and engage in intensive beekeeping. Honey output is increased when a queen-rearing facility is available to increase the number of honey bee colonies [21-23]. Crude honey is in high demand right now from a variety of consumers and businesses for both domestic and export use [28].

Beekeeping presents a significant opportunity for outreach activities for safety net recipients because of its minimal land needs and very affordable startup expenses. Opportunities for youth and the landless on communal lands are provided by cooperative-based production plans [10,21].

Products from beekeeping are important to the growth of the national economy. Among the expanding export commodities with promising prospects in many African nations are honey and other apiculture products such as beeswax, propolis, pollen, royal jelly, and bee venom [6-8].

Crop pollination

In the agricultural system, bees are vital components. Despite the high cost of modern bee hives, honeybees play an important role in pollinating some crops, which is underappreciated [20-24]. They also play a significant role in equipment like modern bee hives, and wax printers, and in boosting national food production and regeneration [8-10]. However, honey extractors are very costly, so farmers of plant species must purchase them. These devices are expensive to purchase and operate, and honeybees are the primary pollinators. Agents everywhere. Their contribution to pollination According to Sahle et al. [21], the price of a single modern bee hive might range from 900 to 1000 ETB, which is more than 15 times the total value of all hives.

Job Opportunities

Beekeeping practices create job opportunities for landless men and women for their livelihood as it needs low capital to start [35]. Due to the inexpensive startup costs, beekeeping provides employment alternatives for landless women and men [34]. At the village, district, and zonal levels, it was also noted that a large number of people (intermediaries and traders) engage in the gathering and selling of honey. The Tej brewing industry employs hundreds of honey processors, and exporters are also thriving. Additionally, it can provide employment opportunities for organized adolescents and local carpenters who build beehives [8,35].

CONCLUSION AND RECOMMENDATION

In many nations, beekeeping plays a significant role in agricultural and rural development initiatives. It contributes to economic, ecological, and nutritional security. Additionally, it is a source of revenue that enhances the beekeepers' yearly income through the sale of bee products and does not compete with other resources in the farming system. Nonetheless, Ethiopia's bee honey manufacturing system faces numerous obstacles. The main obstacles are the absence of bee equipment and the existence of pests and predators. Despite this, it offers numerous advantages, including raising marketing demand, diversifying the honey bee colony government's advocacy campaign, and expanding hive production.

Based on the above conclusion the following recommendations are forwarded:

- Should be increasing the productivity, production, and quality of honey by improving the management of the traditional hives and introducing improved beehives.
- Increasing the productiveness of bee colonies by improving bee forage providing feed and water and introducing bee plants is very important.
- Designing effective honeybee pests and predator-controlling methods.
- There should be the introduction of a full package of improved beekeeping technologies with adequate practical skill training.

LIST OF ABBREVIATION

KTBH: Kenya Top Bar Hive, TTBH: Tanzania Top Bar Hive.

Declaration

Ethics approval and Consent to participate

Not applicable.

Consent for publication

Not applicable.

Availability of data and materials

All the datasets generated or analyzed during this study are included in this manuscript.

Competing interests

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The author contributed to data collection, study design, data interpretation, reference search, manuscript writing, and editing, and all authors have approved the submission of the final manuscript.

REFERENCES

1. Shenkute AG, Getachew Y, Assefa D, Adgaba N, Ganga G, Abebe W. (2012). Honey production systems (Apis mellifera L.) in Kaffa, Sheka, and Bench-Maji zones of Ethiopia. Journal of Agricultural Extension and Rural Development. 4(19):528-541.
2. Mohammed SS, Hassen A. (2021). The Current Constraints and Opportunities of Beekeeping in Ethiopia: A Review. Agriculture Forestry and Fisheries 10(6):262-268.
3. Gezahegne T. (2001). Beekeeping (In Amharic). Ethiopia: Mega Printer Enterprise.
4. Fichtl R, Admasu A. (1994). Honeybee Flora of Ethiopia. Margraf Verlag, Germany. p. 43-50.
5. Dekebo A, Bisrat D, Jung C. (2019). Opportunities and constraints of beekeeping practices in Ethiopia. J of Api. 34(2):169-80.
6. Gratzer K, Wakjira K, Fiedler S, Brodschneider R. (2021). Challenges and perspectives for beekeeping in Ethiopia. A review. Agronomy for Sustainable Development. 41(4):46.
7. Hailemariam A, Tolemariam T,Debele K. (2015). Assessment of honey production system, constraints, and opportunities in three selected Woredas of Tigray Region, Ethiopia.
8. Teferi K. (2018). Status of Beekeeping in Ethiopia review. Dairy and Vet Sci J. 8(4):555743.
9. Chala K, Taye T, Kebede D, Tadele T. (2012). Opportunities and challenges of honey production in Gomma district of Jimma zone, South-west Ethiopia. J Agric Ext Rural Dev. 4(4):85-91.
10. Negash D, Mengeste B. (2019). Assessment of honey production system, constraints, and opportunities in selected kebeles of Hawassa City administration, Ethiopia. Int J of Res Granthaalayah. 7(8):78-87.
11. Nuru A. (2007). Atlas of pollen grains of major honey bee flora of Ethiopia.
12. Fikru S. (2015). Review of honey bee and honey production in Ethiopia. Journal of Animal Science Advances. 5(10):1413-1421.
13. Mekonnen E. Characterization of Honey Production and Marketing Systems: Constraints and Opportunities in Ada Berga District, West Shoa Zone, Oromia, Ethiopia (Doctoral dissertation, Bahir Dar University).

14. Kebede A, Adgaba N. (2011). Honey Bee Production Practices and Honey Quality in Silti Wereda Ethiopia. Honey bee production practices and honey quality in Silti Wereda, Ethiopia.

15. Gebremedhin D. Characterization of Beekeeping Practices and Honey Quality in Chena District, Kaffa Zone, Southern Nation, Nationalities and Peoples Region, Ethiopia.

16. Ababor S, Tekle Y. (2018). Beekeeping practice, opportunities, marketing and challenges in Ethiopia. Dairy Vet Sci. 5:555662.

17. Gebiso T. (2015). Adoption of a modern bee hive in Arsi Zone of Oromia Region: determinants and financial benefits. Agricultural Sciences.

18. Tesfaye B, Begna D, Eshetu M. (2017). Beekeeping practices, trends and constraints in Bale, South-eastern Ethiopia. J Fisheries Livest Prod. 5:215.

19. Abeje A, Ayen K, Awoke M, Abebaw L. (2017). Adoption and intensity of modern bee hive in Wag Hamra and north Wollo zones, Amhara region, Ethiopia. Agricultural and Resource Economics: International Scientific E-Journal. 3(1):5-26.

20. Al-Ghamdi AA, Adgaba N, Herab AH, Ansari MJ. (2017). Comparative analysis of the profitability of honey production using traditional and box hives. Saudi journal of biological sciences. 24(5):1075-1080.

21. Sahle H, Enbiyale G, Negash A, Neges T. (2018). Assessment of the honey production system, constraints and opportunities in Ethiopia. Pharm Pharmacol Int J. 6(1):42-47.

22. Wakjira K, Negera T, Zacepins A, Kviesis A, Komasilovs V, Fiedler S, et al. (2021). Smart apiculture management services for developing countries—the case of SAMS project in Ethiopia and Indonesia. PeerJ Computer Science. 7:e484.

23. Yemane N, Taye M. (2013). Honeybee production in the three Agroecological districts of the Gamo Gofa zone of southern Ethiopia with emphasis on constraints and opportunities. Agriculture and Biology Journal of North America. 4(5):560-567.

24. Edessa N. (2005). Survey of the honey production system in West Shewa Zone: Proceedings of the 4th Ethiopian Beekeepers Association (EBA). Ethiopia.

25. Tekle G, Weldeyohanis S. (2016). Review on challenges and opportunities of honey marketing in Ethiopia. J of Market & Cons Res. 23:33-37.

26. Kerealem E, Tilahun G, Preston TR. (2009). Constraints and prospects for apiculture research and development in Amhara region, Ethiopia. Livestock Research for Rural Development. 21(10).

27. Beyene T, Verschuur M. (2014). Assessment of constraints and opportunities of honey production in Wonchi District South West Shewa Zone of Oromia, Ethiopia. American Journal of Research Communication. 2(10):342-353.

28. Adamte T. Contribution of Socio-Economic Factors On Income Generation Among Urban Apiculture Households in Gullele Sub City, Addis Ababa, Ethiopia (Doctoral Dissertation, St. Mary's University).

29. Faji M, Begna F. (2017). Review of opportunity and challenges of beekeeping in Ethiopia. Advan Res J Plant Ani Sci. 3(3):053-060.

30. Beyene T, David P. (2007). Ensuring small scale producers in Ethiopia to achieve sustainable and fair access to honey markets. Paper prepared for international development enterprises (IDE) and Ethiopian Society for Appropriate Technology (ESAT), Ethiopia.

31. Gezahegne T. (2001). Marketing of honey and beeswax in Ethiopia: past, present and perspective features: Proceedings of the third National Annual Conference of the Ethiopian Beekeepers Association (EBA). Ethiopia. pp. 78-88.

32. Ayalew K, Gezahegn T. (1991). Suitability Classification in Agricultural Development. Ministry of Agriculture, Ethiopia.

33. Berhe A, Asale A, Yewhalaw D. (2016). Community perception on beekeeping practices, management, and constraints in Termaber and Basona Werena districts, central Ethiopia. Advances in Agriculture. 2016(19):1-9.

34. Bojago E. (2022). Adoption of Modern Hive Beekeeping Technology: Evidence from Ethiopia. InHoney-Composition and Properties. Intech Open.

35. Tarekegn A. (2022). Traditional Forest Beekeeping and Its Challenge in Benishangul Gumuz Regional State, Ethiopia. Bee Studies. 14(1):27-34.