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Apicultural Knowledge for Ecological Sustainability, Food Security and Economic Empowerment: A Case of Kajiado County, Kenya

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Abstract

Kajiado County, located in Kenya, faces interconnected challenges of ecological sustainability, food security, and economic empowerment. Amidst these challenges, beekeeping has emerged as a promising solution with the potential to address these multifaceted issues. This study examined the apiculture knowledge in Kajiado County, Kenya, for ecological sustainability, food security, and economic empowerment. The research utilized a mixed-method approach to collect data from beekeepers. The data collection methods used were observations, interviews, and focus group discussions. Data was analyzed using summary statistics and presented in the form of percentages and descriptions. The study revealed that the main motivation for beekeeping for all farmers was honey production while 30% kept bees for cultural practices and medicinal purposes. Beekeepers faced a myriad of challenges which ranged from negative attitudes towards beekeeping by young people at 10% to dry climatic conditions at 100%. Other major challenges included swarming of bees at 75% and attacks by pests and rodents at 83%. These problems were solved by providing water to the bees which was practiced by 100% of the beekeepers, removal of pests manually at 75%, and use of special indigenous trees to make hives with cooler temperatures. As an alternative source of livelihood in the ASALs being championed by the County governments since it is less affected by the adverse effects of climate change, the uptake of apicultural practices is still low in Kajiado largely due to a strong attachment to pastoralism. The apicultural practices in Kajiado County are largely small-scale and traditional with insignificant modernization. However, its practice has led to the management and conservation of some shrubs and trees, hence biodiversity conservation. The study recommends that traditional beekeepers be supported through the provision of relevant knowledge of beekeeping and modern equipment in order to increase both the quantity and quality of honey production for enhanced food security, economic empowerment and ecological sustainability.

Keywords: ***Apiculture, food security, empowerment, sustainable agriculture***

Introduction

Apiculture or beekeeping is the art of rearing honey bees for the commercial production of honey and other bee products. It is a traditional practice in many parts of the world but has eventually evolved to be a commercial venture in the present day. It is a source of supplementary income for countless people in rural areas where sources of income are limited (Sain & Nain, 2017). Apiculture is not a new phenomenon in Kenya. It has existed since time immemorial with some communities, such as the Ogiek, depending on honey as one of their staple food, medicine and meat preservatives (Kathila, 2017). To a great extent, apiculture in Kenya has remained a traditional practice dominated by the elderly. Kathila (2017) further observes that apiculture among the original beekeeping communities is rapidly decreasing. However, today Kenya has an Apiculture Research Institute whose main aim is to support and promote apiculture, particularly modern practices. As a result, modern apiculture, as a commercial venture has taken root although the rate of uptake remains low. Among the factors that have contributed to the low uptake include a lack of knowledge and awareness, a negative

perception of beekeeping, social-cultural underpinnings and priority to other activities (Hecklé, et al. 2018). Modern apiculture is largely concentrated in agriculturally productive areas and is being practiced by young people (Nzula, 2018).

Garissa and Tana River Counties, which lie in the semi-arid areas of Kenya, are greatly affected by the vagaries of climate change. The hardship caused by climate change has triggered diversification of livelihood from dependence on pastoralism to charcoal burning, small business, and small-scale crop farming. In addition, the county governments have introduced apiculture as one of the adaptation strategies against climate change. Very little information exists on beekeeping practices in Kenya as very little qualitative or quantitative data has been collected. This project aims to fill the information gap by assessing the perceptions of beekeeping in arid and semi-arid areas (pastoral communities in Kenya).

One of the main elements of adaptive capacity is knowledge. As Khalwale, et al. (2018) observed, there is a strong relationship between environmental conservation and the education level. The overall literacy level in Arid and Semi-Arid Lands (ASALs) is less than 20%. The majority of the farmers, in the farmers' groups, who were presented with beehives by the respective county governments were of low literacy levels or had no formal education at all, especially women. They not only lack adequate knowledge of modern beekeeping but also have limited capacity to adapt to suitable technologies for harvesting, storage and processing. Apiculture requires constant training (Nzula, 2018), in addition, most of the farmers' groups are formed with the intention of benefiting from donor funding rather than agricultural activities. Together with the strong culture that revolves around pastoralism, these factors combined have led to low uptake as well as very poor up- and out-scaling of apiculture in the area.

This study focused on assessing the motivation behind bee-keeping among pastoral communities in Kajiado County and establishing the challenges encountered by beekeepers. The activities of this research aimed at feeding into Sustainable Development Goals (UN, 2012) on Multi-stakeholder partnerships (SDG 17.16); ending poverty (SDG 1. a); sustainable management and efficient use of natural resources (SDG 12.2) and climate resilience and adaptation (SDG 13. b).

Methodology

The research was implemented in Kajiado County (Figure 1) in Isinya-Kajiado area. The County is characterized by semi-arid to arid climates with mean annual rainfall and temperature of 275 mm 36°C respectively. The main economic activity is pastoralism, a source of livelihood for 90% of the inhabitants. As per the 2019 census, Kajiado County's population was 1,117,840 with approximately 39% being youths (15-29 years) (KNBS, 2019). Snowball sampling technique was used, whereby every interviewed beekeeper subsequently referred the researcher to the next participant, creating a chain of referrals within the beekeeping community. A total of 12 beekeepers' respondents were interviewed in order to establish the motivation for beekeeping, attitude towards beekeeping as well as challenges facing beekeeping activities. The iterative nature of this process allowed the researcher to tap into a comprehensive understanding of the subject matter, ensuring that key themes and patterns were exhaustively explored within the given research scope. The researcher conducted interviews with beekeepers until a point of informational redundancy was achieved. Data saturation was considered reached when successive interviews yielded no substantially new insights or information regarding the practices and experiences of beekeepers in the region.

Figure 1

Map of Kajiado County in Kenya

Results

Motivation for Beekeeping

In an environment where pastoralism is not only the main source of livelihood but also has a strong cultural significance, the study sought to establish the factors that had motivated some farmers to venture into beekeeping practices. The results are shown in Table 1.

Table 1

Motivation for Keeping

Motivations for Beekeeping	Percent
Produce honey for sale/ export	100%
Cultural practices and medicinal purposes	30%
Facilitate pollination in rose and avocado farms	10%
Integration with other agricultural ventures	10%
Family tradition and inheritance from parents	10%

The motivation for beekeeping varied depending on the scale of production. The factors that motivated small-scale pastoralist farmers, were different from those of the large-scale bee farms in the area. For example, the motivation for starting the bee farm was to produce honey to export (100%) as well as facilitate pollination in roses and avocado farms (10%). In this regard, beekeeping in the bee farm was a commercial venture that required proper management. Motivation for small-scale beekeepers varied from one farmer to the other mainly because it was mainly driven by socio-cultural rather than economic gains. The main motivations for beekeeping were the production of honey for cultural practices and medicinal purposes (30%) and the family tradition of beekeeping (inheritance from parents) (10%).

To a very small extent, some farmers kept bees as a deterrence for livestock that invaded the cropped lands (10%). As a result, small-scale farmers largely used traditional hives that were made from logs (Figure 2) and used honey and wax to attract swarming bees. However, a few of the farmers had adopted modern apiculture and thus used Kenya Top Bar Hives (KTBH), and had modern equipment such as honey extractors, bee suits, smokers, and brushes.

Figure 2

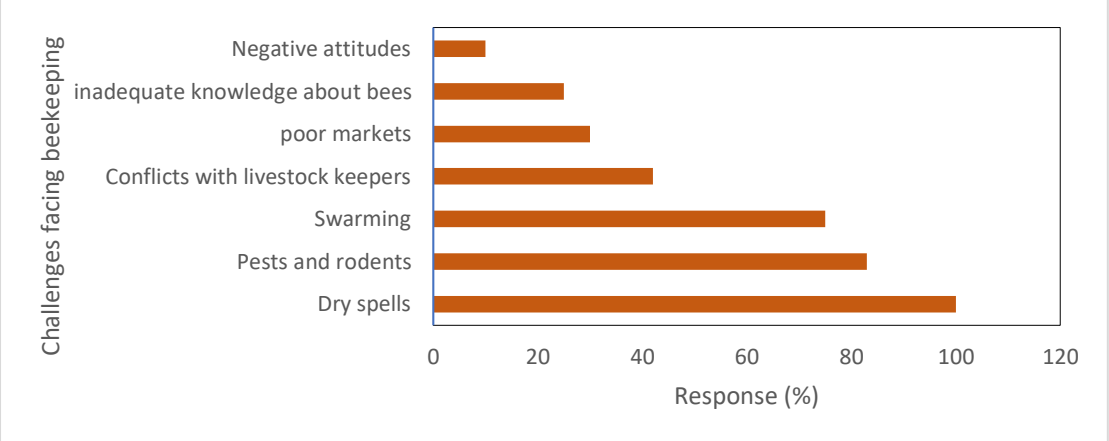
Traditional Log Hives

Challenges of Beekeeping in Kajiado County

Bee farmers experienced several challenges most of which were associated with the level of knowledge about beekeeping amidst climate change. Figure 3 presents the challenges as stated by the respondents.

Figure 3

Challenges Facing Beekeeping Practice in Kajiado County



Dry Spells. All respondents identified that lack of rainfall as one of the main challenges that affect apiculture in their area. Lack of rain as well as excessive heat during drought periods results in reduced production of flowers and lack of water necessary for honey production. Remarkable declines in honey amount were recorded during the dry season as bees consume much of the honey already produced.

Inadequate knowledge about apicultural practices. About 25% of the respondents indicated that they had limited modern knowledge about beekeeping and relied mostly on traditional knowledge. Modern knowledge of beekeeping was very scanty even among the apiarists working on the bee farm. For instance, the majority of the beekeepers and apiarists were not conversant with the life of a bee, conducive environment for bees, bee stressors and the importance of bees in the ecosystem. Except the commercial bee farmers, small-scale farmers did not know other bee products except honey. This resulted in reduced income making the venture unattractive, particularly among the young people.

Pests and rodents. Pests and rodents posed a major challenge to 83% of the small-scale beekeepers. Major pests included ants, wax moths and monkeys. Wax moths (Figure 4) caused reduced honey production and swarming. The wax moth larva digs tunnels in the comb and leaves a thick layer of silk webs on the frame while it feeds on pollen, honey, wax, brood, and old honeybee pupal skins. In addition, the emergent bees get entangled in the silk webs where they starve to death eventually resulting in colony loss (Kwadha, et al, 2017).

Figure 4

A Hive Infested with Wax Moth

Swarming of bees. Swarming affected about 75% of the beekeepers. It occurred during the exceptionally dry season which caused shortages of flowers where bees would forage and lack of water. Swarming was also caused by infestations of beehives by pests and the use of chemicals (insecticides and herbicides) in the neighbourhood. A farmer reported that: *"Bees would swarm when my herbicides are applied in nearby farms or livestock sprayed with pesticides."*

Negative Attitude for Beekeeping

Despite the efforts by the County governments and other stakeholders to promote apiculture as an alternative source of livelihood in ASALs, young people perceived beekeeping as a practice for old people as it was indicated by 10% of the respondents. This was compounded by the fact

that small-scale beekeeping was largely practiced along family lines with some specific households being predominantly beekeepers. Thus, the young people who were expected to be early adopters showed no interest in apiculture. A farmer reported:

> *"Beekeeping in this area requires one to be patient for one to start earning but young people here want quick money. They do not want to keep bees as an income-generating activity since it will take long hence a very negative attitude and low interest towards beekeeping. Very few, if any, are willing to take up the activity from their parents leading to loss of necessary beekeeping skills."*

Lack of ready market. It was reported by 30% of the respondents that there was no ready market for the bee products. Beekeepers sold the honey in small quantities either to buyers for home consumption or for medicinal purposes. Where middlemen were available to buy the honey, they offered very low prices taking advantage of farmers' lack of market information. They would buy a kilogram of honey selling at Kshs 400 (USD 3) compared to approximately Kshs 1000 (USD 8) at the supermarkets and other herbal medicine shops outlets. Alternatively, beekeepers would sell the honey in open-air markets during seasons when the production was high.

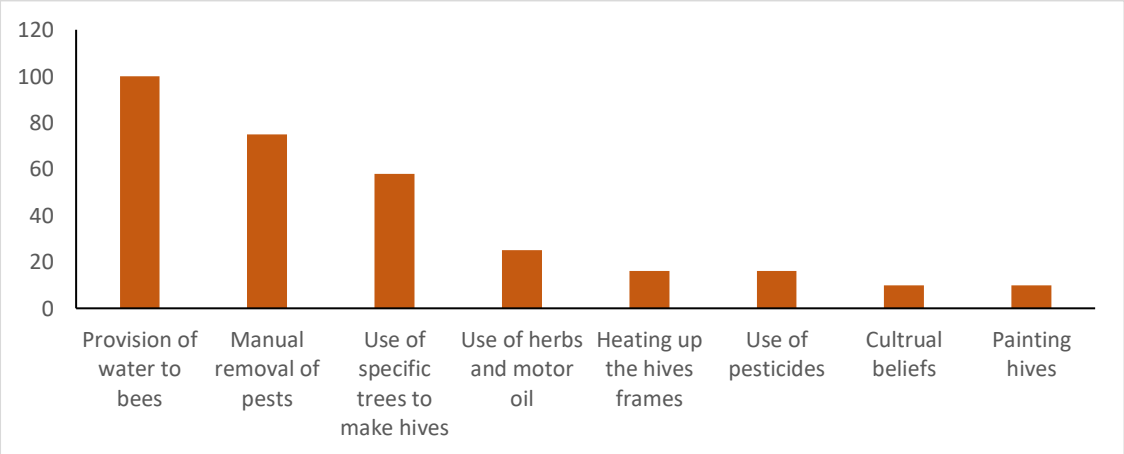
Conflict between beekeepers and livestock keepers. This challenge was cited by 42% of the respondents. It was noted that irritated bees would occasionally go wild stinging people and livestock. The use of pesticides on livestock, for instance, would irritate the bees making them violent hence stinging the livestock. This brought conflicts between beekeepers and livestock keepers in the community. In most cases, bee stings led to the loss of livestock. For instance, donkeys were easily killed by less than five bee stings. To avoid loss of livestock through bee stings, livestock keepers chased the bees away whether natural swarms or the ones kept by beekeepers. Thus, despite huge flowering trees suitable for bee forage in some areas, beekeeping was rarely practiced because of the large number of livestock.

Solutions to the Challenges Facing Beekeeping

Beekeeping in the area was largely small-scale with the large-scale bee farm being a relatively new venture in the area. As such, beekeepers relied on local and indigenous knowledge to solve the challenges that affected beekeeping as shown in Figure 5.

Figure 5

Methods Used to Solve Beekeeping Challenges in Kajiado County



***Heating up the hive frames*.** This method was practiced by 16% of the beekeepers. Hive frames were heated by passing them on fire in order to kill pests such as wax moths and ants. Feeble twigs were used to make weak fire flames that would not burn the hive frame but adequate to burn the web and kill the moth eggs and larvae. According to Gulati and Kaushik (2004), when hive frames are exposed to high temperatures (40-800c) for a period of 1-4 hours, wax moths are eradicated

***Manual removal of pests*.** The majority (75%) of the beekeepers manually removed the wax moths, or their eggs and larvae. The apiarist would predict the presence of wax moths in the hive when some natural predators of wax moths such as birds, wasps and beetles frequented the hives. Once spotted, the apiarist removed them manually before they caused any damage. This method, therefore, was effective where regular hive inspections were done.

Use of specific trees for hive making. One of the challenges of beekeeping in ASALs is excessive heat during dry spells. To keep the hives cool, specific indigenous trees that retain natural coolness were used to make hives. The trees included *Sclerocarya birrea, Terminalia brow, Terminalia kili, Cordia sine, Melia volkensi and Ficus sycomorus*. To further keep the hives cool, they were kept under cool temperatures by hanging them on trees with good shade. This practice led to the management and conservation of the trees that provided wood for curving hives, providing shades for hives as well as flowering trees that provided nectar.

Painting of hives. Painting of hives was a relatively new method in the area and was practiced by about 10% of the beekeepers. It involved painting the exterior parts of the hive with colours that reflect heat. The use of this method was occasioned by shortages of special indigenous trees used in making hives as well as the high costs of hives from such trees. Interviews revealed that this method was gaining popularity because it was cheap and easily accessible.

Provision of water to bees. Bee requires water for their survival and in the production of honey. Unfortunately, Kajiado County suffers from severe water shortages due to prolonged droughts. This condition forces bees to move long distances in search of water which occasionally leads to swarming. To minimize the challenge of water shortages, all the beekeepers in the study area provided water to bees. Where hives were close to the homesteads, especially for small-scale beekeepers, bees were provided with water in small containers that were placed near the hives. For largescale beekeepers, the source of water for bees was from an earth pan constructed within the farm.

***Use of traditional herbs and used motor oil*.** Approximately 25% of the small-scale beekeepers used traditional herbs or used motor vehicle oil to keep away some harmful insects such as black ants from accessing the hives. The traditional herbs produced unpleasant smell that repelled the black ants. The used motor vehicle oil on the other hand was applied at the base of the hive stands/ trees to prevent the ants from climbing up to the hives. This practice led to conservation of shrubs that provided the herbs.

Cultural beliefs. It is a taboo among the Maasai community to chase away bees as it was believed that such an act would bring a good or bad omen to the community. It was believed that if the chased bees flew to the west, they will bring a bad omen to the community. Thus, as a precautionary measure, only the community elders were allowed to chase the bees. About 10% of the beekeepers held to this belief that hence protected bees from human attacks.

Use of chemicals. The use of pesticides was an emerging measure. It was practiced by about 16% of the bee keepers. Like the motor vehicle oil, the pesticides were applied at the base of the hive stands/ trees to prevent the attack by the black ants. While this practice was repelled insects that could have otherwise attacked the hives, it led to swarming of bees overtime.

Conclusion

Beekeeping has enormous potential in ASALs where the adverse effects of climate change have dwindled the main sources of livelihoods. In the attempt to subsist, the residents exploit the immediate environment leading to severe degradation. As an adaptation measure, some of the County governments such as Kajiado have introduced apiculture as an alternative source of livelihood since it is less affected by droughts and leads to conservation of the environment. However, the uptake of apicultural practices is still low in Kajiado largely due to a strong attachment to pastoralism.

In addition, inadequate knowledge as well as negative attitudes toward beekeeping has further deemed the uptake of apiculture. Thus, apicultural practices on a small scale have remained traditional with insignificant modernization. The bee farm (large-scale) practiced modern ways of beekeeping. With the practice of beekeeping, some shrubs and trees were managed and conserved due to their significance in the practice. There are elements of ecological conservation in the traditional methods of solving the challenges of beekeeping. Therefore, the promotion of apiculture in the ASAL has great potential not enhancing food security and economic development but also for ecological sustainability.

Recommendations

Despite the role of beekeeping in food security and ecological sustainability, little economic benefits have accrued from the practice due to reliance on traditional methods. The study recommends that traditional beekeepers be supported through the provision of modern beekeeping equipment in order to increase both the quantity and quality of honey production. Also, to ensure the economic viability of beekeeping, capacity building and effective marketing strategies for hive products should enhanced.

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