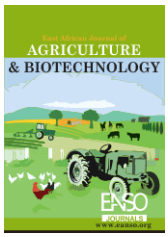

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Original Article

Indigenous Practice on Behavioural and Productive Characteristics of Local Honeybee (Apis Mellifera) Sub Species at Southern Oromia Region, Ethiopia

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ABSTRACT

This study aimed to identify and document indigenous practices regarding the behavioural and productive characteristics of different local honeybee (Apis mellifera) populations in the Southern Oromia region of Ethiopia, where beekeeping plays a crucial role in rural livelihoods and ecological sustainability. Data were collected using a multi-faceted approach, including structured questionnaires, focus group discussions (FGDs), and in-depth interviews with key informants, such as experienced beekeepers and community elders, who possess valuable traditional knowledge. The study sample included a wide range of beekeepers, with the majority (44.62%) between the ages of 24 and 32, and 26.15% between 16 and 24, extending overall from 16 to 65 years. Most beekeepers primarily relied on indigenous knowledge passed down through generations for honey production, maintaining traditional beehives, typically hung on trees near their homesteads. Through their practical experience, beekeepers developed a unique classification system, grouping honeybee colonies into distinct categories based on physical characteristics, such as colour, body size, character, and honey yield. Specifically, they distinguished colonies as either "black" or "red" based on body colour, with the black ecotype being favoured due to its perceived superior productivity, adaptability to local environmental conditions, and lower tendencies for absconding and seasonal migration. This preference indicates the black honeybee's suitability for stable and productive honey yields in this region. To further support and enhance these traditional practices, it is recommended to evaluate the behaviour and productivity of local honeybee populations from different agro-ecological zones under controlled experimental conditions. Additionally, providing practical training in honeybee biology, behaviour, and selective breeding could enrich local beekeepers' knowledge, ultimately leading to improved honey production, preservation of valuable ecotypes, and sustainable apiculture development in the region.

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INTRODUCTION

Indigenous knowledge refers to the distinctive understandings, skills, and philosophies that have developed within specific cultures or communities over generations (Mbah *et al*., 2012). This knowledge is deeply rooted in a society's long-standing relationship and interaction with its natural environment, shaping its ways of living, resource management, and cultural practices.

Ethiopia has a longer tradition of beekeeping than any country in the world even though the sector is still an undeveloped subsector of agriculture (Girma *et al.*, 2008). The contrasting geomorphic landscapes of Ethiopia create a favourable environment for the existence of a large and unique biodiversity (Ejigu *et al.*, 2009). Owing to the varied ecological and climatic conditions, the country is home to some of the most diverse flora in Africa. Ethiopia is the fifth major country in tropical Africa in terms of the diversity of flora; this diversity makes it highly suitable for sustaining a large number of bee colonies (Nuru, 2007).

Beekeeping is an important agricultural activity in Ethiopia. It is especially suitable in semi-arid areas where other modes of agriculture cannot be sustained effectively. Five honeybee races, *A. mellifera scutellata*, *A. mellifera jemenitica*, *A. mellifera bandasii*, *A. mellifera monticola* and *A. mellifera woyi-gambella,* are recorded in Ethiopia and, it is reported that *A. mellifera scutellata* can be found in the southern part of the country (Amssalu *et al*., 2004). Traditional beekeeping is a part of cultural heritage and has been practised by rural people. This technique of beekeeping has been passed from generation to generation since time immemorial. Beekeeping is predominantly based on indigenous knowledge and the use of locally available materials. Different studies showed that inappropriate skill of bee management practices, colony absconding, poor design of modern beehives, low honey yields, and bee pests are the major problems that impede the full use of apiculture resources.

The indigenous knowledge and practices of beekeeping could be a significant basis for the development of modern beekeeping in rural communities (Pudasaini, 2018). Farmers in Ethiopia have developed their own selection criteria from their long years of beekeeping experience. Selection of honeybee colonies adapted to local conditions with its appropriate management practices is an important step for the success of the beekeeping sector and hence harvesting of desired products from honeybees. Generally, it is expected that there is ample indigenous knowledge of beekeeping among our communities. It is very imperative to identify and document the available indigenous knowledge and practices on beekeeping for further improvement and development of the beekeeping sector. Therefore, the objectives of the study were to assess and document the local knowledge and experience of beekeepers, and to characterize the behavioural and productive performance of the

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local ecotypes of honey bees for honey production in the Borana zone.

MATERIALS AND METHODS

Description of the study area

The study was conducted in the Taltale, Yabello, and Arero districts of the Borana zone, Oromia regional state. The Borana Zone is located about 565 km from Addis Ababa, in southern Ethiopia. The zone lies between 4˚3′N to 5˚N and 37˚4′ E to 38˚2′ E with a total area of approximately 95,000 km². The elevation of the area ranges from 1000 to 1600 m a.s.l. (Coppock, 1994). Borana zone has a bimodal rainfall pattern with the main rainy season (Ganna) between March and May, the peak being in April (Coppock, 1994). The short rainy season (Hagayya) extends from September to November with a peak in October. There is a shift in time and in duration and hence in total amount of rainfall. The mean annual rainfall of the zone ranges from 352 mm in the southern part to 605 mm in the northern part of the zone. The mean annual rainfall is 587.2 mm. The mean monthly minimum and maximum temperatures of Yabello are 15.6 and 18.8^{0}C, respectively, with a mean annual temperature of 18.3^{0}C.

Sampling and data collection method

Three representative districts were purposively selected based on their potential for beekeeping, agro-ecological representativeness and accessibility to transport facilities. From each district, three potential peasant associations (PAs) were selected. From each PA, 22 beekeepers were randomly selected and interviewed using structured and semi-structured questionnaires. Beekeepers were given the opportunity to list ecotypes of honeybee races, colony selection criteria for honey production, and characterize the behaviour of each ecotype of the honeybee race.

In addition, focus group discussion (FGD) and key informant interviews were used to collect information. In each target study area (Kebeles), participants for FGD and key informant interviews were represented by both genders of different ages. The checklist by which the participants are guided was prepared and the values were taken as true information upon consensus. The discussion focused on the importance of honeybees, types of local honey bee ecotypes, selection criteria and their management practices.

Method of data analysis

Simple descriptive statistics (mean, standard deviation, and percent values) were used to summarize the nature of respondents, their experience with beekeeping and their management practices.

RESULT AND DISCUSSION

Socio-economic characteristics of the sampled households

Of the total respondents, about 96.9% were male, while the remaining 3.1% were female (Table 1). A few female respondents were engaged in beekeeping activities due to a low level of awareness in encouraging women in the community. Beekeeping is taken as only a man's occupation. This is in agreement with previous reports by Abebe (2011). Regarding the age of the respondents, the majority of beekeepers (44.62%) were between 24 and 32 years of age, while 26.15% were between 16 and 24 years, the range being between 16 and 65 years. This indicates beekeeping is practised by active age groups. The Educational background of the beekeepers indicated that the majority (60%) were illiterate. The remaining 27.7, 9.2, 1.5, and 1.5% were in primary school, secondary school, informal education, and 12 plus levels of education, respectively.

With regard to marital status, the majority of them (83.1%) were married, while the remaining 15.4% and 1.5% were unmarried and divorced, respectively. With regard to religion, the majority of the respondents were *Wakefata* (67.7%) and the remaining were *Muslim* (20%) and *Protestant* (12.3%).

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Table 1: Personal characteristics of respondents

Social characteristics	Frequency	Percent
Gender		
Male	63	96.9
Female	2	3.1
Age		
16-24	17	26.15
24-32	29	44.62
32-40	4	6.15
40-48	7	10.77
48-56	5	7.69
56-65	3	4.62
Education level		
Illiterate	39	60
Primary school	18	27.7
Secondary school	6	9.2
Informal education	1	1.5
12 plus	1	1.5
Marital status		
Married	54	83.1
Unmarried	10	15.4
Divorced	1	1.5
Religion		
Wakefata	44	67.7
Muslim	13	20
Protestant	8	12.3

Beekeepers experience and sources of colonies

Beekeeping is an important agricultural activity in the study area, contributing significantly to income generation, poverty reduction, and biodiversity conservation. In this region, beekeeping is primarily practised as a part-time activity, with no respondents relying solely on beekeeping as their primary source of income. Beekeepers in the area utilize their indigenous knowledge for honey production, using traditional log and basket hives, which are deeply rooted in local practices. The majority of beekeepers (63.1%) reported acquiring their beekeeping experience from their neighbours, while a smaller proportion (32.3%) learned from their parents. A small percentage (4.6%) mentioned gaining their beekeeping knowledge from both parents and neighbours. The beekeeping experience of respondents varied, with most having between 6 and 10 years of experience (Table 2). This suggests that Indigenous beekeeping practices have been passed down through generations, reflecting a long-standing tradition of knowledge transmission within families and communities. This continuity highlights the importance of preserving and strengthening indigenous knowledge in order to further enhance the sustainability and productivity of local beekeeping practices.

With regard to sources of honeybee colonies to start beekeeping, catching natural swarms was reported to be the only source of honeybee colonies in the area. According to Tilahun *et al.* (2016), other sources of honeybee colonies in addition to catching swarms include purchasing and inheritance. The overall average number of colonies owned by beekeepers is 8 with a minimum of 1 and a maximum of 32 colonies per beekeeper. The majority of beekeepers use traditional bee hives for their colonies by hanging the hives on trees near their homesteads (Figure 1).

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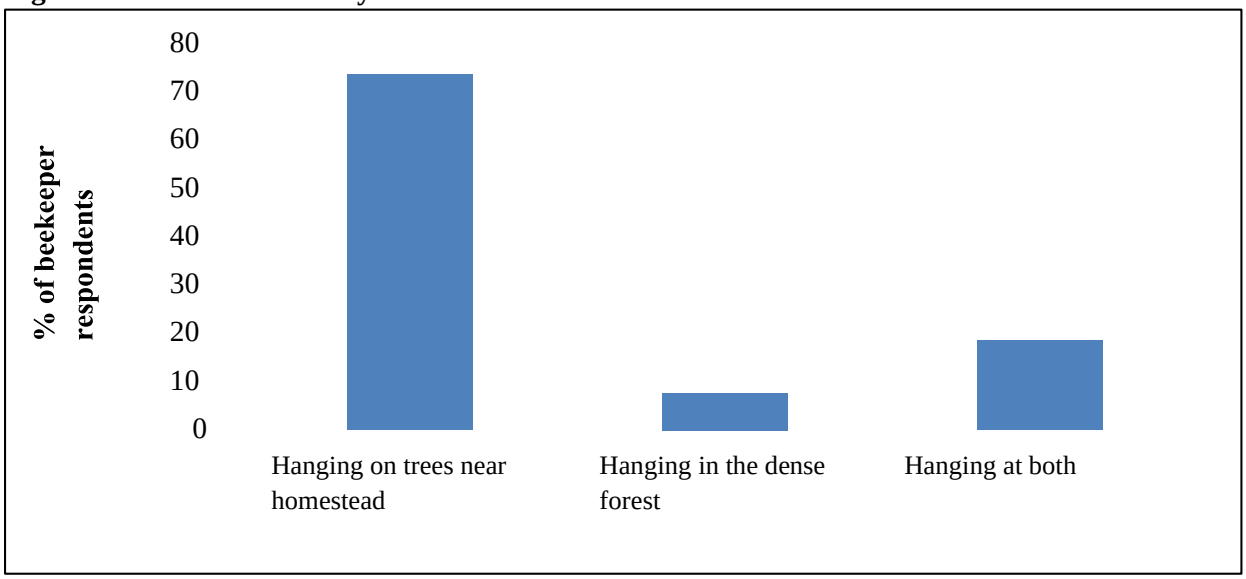
Table 2: Beekeeping activities and the beekeepers' Indigenous knowledge in the areas

Knowledge attribute	Frequency	Percent
Years of experience		
Less than 5	21	32.3
6-10	19	29.2
11-20	18	27.7
More than 20	7	10.8
Sources of experience		
Parent	21	32.3
Neighbour	41	63.1
Parent and neighbour	3	4.6
Nature of beekeeping		
Part-time	65	100
Full time	0	0
Harvest frequency per year		
Once	3	4.6
Twice	37	56.9
Three times	25	38.5
Indicators for harvesting time		
Accumulation of bees around the hive entrance	6	9.23
Less/no traffic and accumulation of bees, end of flowers	21	32.3
Ends of flowering	31	47.69
Ends of flowering and opening the hive	7	10.76

Figure 1: Placement of honeybee colonies



Beekeepers' Knowledge of local honeybee races and selection

In the surveyed area, beekeepers recognized honeybee castes in the colony by their size, stinging, and numbers in the colony. However, the majority of them in all districts did not know clearly the role of each caste in the colony. Though the majority of beekeepers were not aware of common honeybee races, they were able to categorize them based on different parameters (Table 3).

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Table 3: Beekeepers' knowledge of the biology of bees

Variable	Arero		Yabello		Taltalle	
	Freq	Percent	Freq	Percent	Freq	Percent
Cast identification						
Can identify	11	68.75	15	68.18	22	81.48
Can't identify	5	31.25	7	31.82	5	18.52
Total	**16**	**100**	**22**	**100**	**27**	**100**
Role of each caste						
Know role	6	37.50	3	13.63	8	29.63
Don't know the role	10	62.50	19	86.37	19	70.37
Species of Honeybees						
Can differentiate	15	93.75	20	90.90	22	81.48
Can't differentiate	1	6.25	2	9.10	5	18.52
Classification based on some criteria						
Yes	15	93.75	21	95.45	26	96.30
No idea	1	6.25	1	4.55	1	3.70

Subspecies of common honeybees

Beekeepers have their own methods of categorizing their honeybee colonies, mostly based on the colour of the bees. Based on the indigenous knowledge of the beekeepers locally available, honey bee colonies were classified into two groups considering physical characteristics such as colour, body size, honey yield history, aggressiveness and direction of comb building. Accordingly body colour, body size, and colony population were the first three parameters used for the classification of local honeybees (Table 4). Likewise, beekeepers in the Tigray and Amhara regions carried out honeybee selection based on body colour, colony population, and production potential (Tilahun *et al*. 2016; Aynalem & Mekuriaw, 2017), respectively.

Researchers recognized that honeybee colonies in the study area construct their combs in two directions, locally named *Qurxaa* and *Dheerrina*, irrespective of the types of honeybees. *Dherina* is the one where combs are built straight along the length of the traditional hive, and *Qurxaa* is perpendicular to the length of the hive. In traditional hives, beekeepers prefer honeybee colonies that construct their comb in a perpendicular pattern to the length side '*qurxaa*', as this facilitates easy harvesting and better honey yield. In Tigray, three comb construction directions were applied by beekeepers (Tilahun *et al.*, 2016) namely the *Salah*, where combs are built along the length of the traditional hive, the *Difoe*, where combs are built perpendicular to the traditional hive length, and the *Goni/Seyaf*, where combs are built neither parallel nor perpendicular to the length of traditional hive, but slanting along the length by some angle to the width. In this regard, beekeepers can guide bees to build combs following their preference by providing strips of wax in the internal part of the traditional hive to make honey harvest easy and maximize honey yield (Abebe, 2011).

Table 4: Beekeepers' Colony selection criteria and categories

Selection criteria	Categories	Score	Rank
Body size	Small & big	23	2nd
Body colour	Red & black	54	1st
Colony population	Strong & weak	22	3rd
Aggressiveness	Aggressive & less aggressive	15	5th
Honey yield history	Productive & less productive	16	4th
Direction of the comb building	Round *(qurxa)* and straight *(dherina)*	11	6th

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Beekeepers' knowledge of behavioural and productive characteristics of honey bees

The study demonstrated that beekeepers in the area possess a high level of experience in identifying and characterizing the different local honeybee colonies. A significant majority of respondents described black-colour honeybees as more productive and aggressive, with a reduced tendency to swarm but a higher rate of absconding when compared to red-colour bees (Table 5). In fact, around 60% of the beekeepers in the study areas expressed a clear preference for black-colour local bees (Figure 2). They believe that these colonies are not only more productive but also better adapted to local environmental conditions. Additionally, they noted that black-colour bees are more resilient, capable of surviving prolonged dry spells, and can build up early in the season, which they consider essential for successful honey production. On the other hand, 35% of the respondents preferred red-colour bees for beekeeping, while the remaining 5% did not express a clear preference for either colour (Figure 2).

Interestingly, these findings contrast with those of Aynalem and Mekuriaw (2017), who selected brown-red honeybee ecotypes as the best for honey production, based on their productivity. However, similar to the current study, their research also highlighted that black-colour local honeybees were favoured for their superior drought tolerance and ability to survive in times of feed shortage, which aligns with the current study's findings. Despite the beekeepers' clear selection preferences for specific types of honeybees, the study found that they do not manage their colonies differently based on the bees' colour or categorization. This suggests that, although beekeepers recognize differences in productivity and adaptability between colony types, these insights are not yet fully integrated into their management practices, and further training may be needed to help them tailor their management strategies to optimize honey production based on colony characteristics.

Figure 2: Beekeepers' honeybee colonies preference

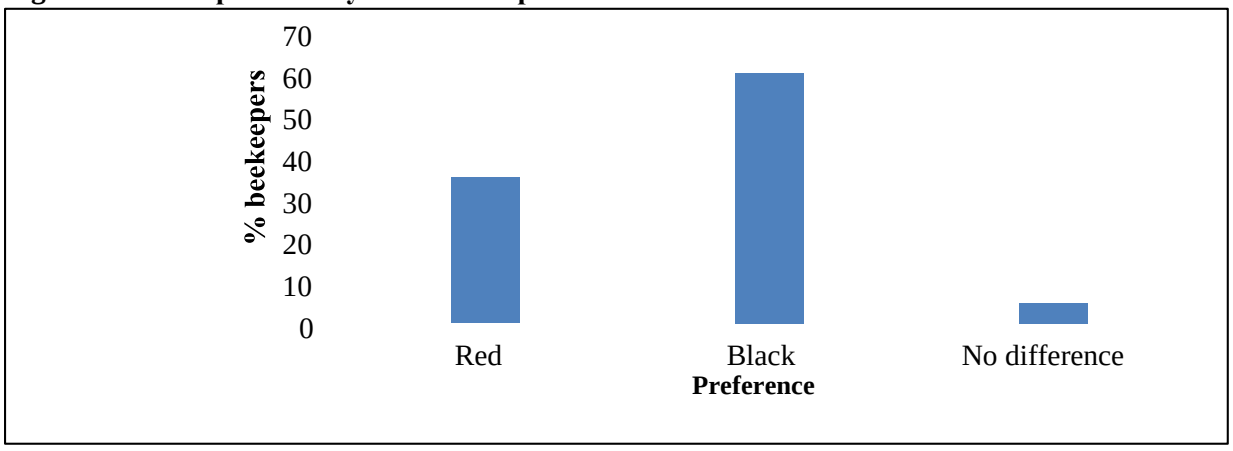

Table 5: Respondents' view on distinctive behaviours of the two types of bee colonies

Red colour honeybee ecotypes	Black colour honeybee ecotypes
Less productive	More productive
Docile compared to black	Aggressive
Lower swarming tendency	Higher Swarming tendency
Higher absconding and migration tendency	Lesser absconding and migration
Adaptable	Higher adaptability
Physically smaller than black	Bigger than red

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CONCLUSION AND RECOMMENDATION

In the study areas, beekeepers have gained extensive experience and indigenous knowledge regarding the behavioural and productive traits of their honeybee colonies. Based on this knowledge, they commonly classify their honeybee colonies by colour, identifying them primarily as either black or red. This categorization, rooted in local observation and hands-on experience, reflects their understanding of subtle differences in colony traits that may influence productivity and adaptability.

Despite their aggressiveness and higher tendency to swarm, black-colour ecotypes of honeybees are highly favoured by beekeepers due to their greater productivity and low rates of absconding and migration. To enhance honey production and harness these local preferences, practical beekeeping training on the biology and behaviour of honeybees should be provided. Such training would allow beekeepers to build on their indigenous knowledge, helping them to better manage productive colonies and initiate breeding programs that emphasize desirable traits.

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