Direct Research Journal of Agriculture and Food Science

Vol. 12(3), Pp. 65-72, October 2024,

https://journals.directresearchpublisher.org/index.php/drjafs

Research Article
ISSN: 2354-4147

Assessing Apicultural Practices and Bee Species Identification from Northern and Southern Guinea Savannah zones of Niger State

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ABSTRACT

This study provides insights into the demographic characteristics, educational background, and beekeeping practices of honey farmers in Nigeria. The findings show that the majority (88.9%) of honey farmers are males, consistent with prior studies, with lower female participation attributed to the risks associated with bee stings. Most farmers are over 50 years of age, which differs from previous research that identified a younger demographic in honey farming. A significant proportion of the farmers have formal education, which has facilitated the adoption of improved beekeeping technologies. Additionally, 63% of the farmers have 6-10 years of experience, indicating a strong level of expertise within the sector. However, traditional beekeeping methods are still widely used by 51-90% of farmers, resulting in lower honey yields, poor marketability, and higher levels of contamination. The predominant bee species identified in the study is Apis mellifera adansonii L, the primary honey-producing species in Nigeria and other African countries.

Keywords: *Apicultural Practices, Bee species, Northern and Southern Guinea Savannah zones*

Received 13 August 2024;
Accepted 26 September 2024;
Published 26 October 2024
https://doi.org/10.26765/DRJAFS24664303

Citation: Aminuwa, H. A., Abdulazeez,A. K., Kura, S. I. and Otu, B. O. (2024). Assessing Apicultural Practices and Bee Species Identification from Northern and Southern Guinea Savannah zones of Niger State. *Direct Research Journal of Agriculture and Food Science*. Vol. 12(3), Pp. 65-72.

INTRODUCTION

Honey is a natural sweet substance produced by honey bees from the nectar blossoms or the secretion of the living part of plants (Ebrahimi *et al,* 2023), which honey bees collect, transform, combine with specific substances of their own, store, and leave in the honey comb to ripen and mature (CODEX, 2001; Ma *et al*., 2019; Singh, 2022; Walker *et al*., 2022; Aminuwa *et al*., 2024a). It is processed by honeybee (*Apis mellifera*) (Pridal *et al*., 2023), a social insect known as the most economically valuable insect because of its honey production and pollinating activities (Adeyemi *et al*., 2021). Honeybees have been described as the most useful of all insects because of their ability to provide the basic services necessary for the survival of human and other forms of life (Khalifa *et al*., 2021; Brant *et al*., 2022; Aminuwa *et al*., 2024b). In contrast, other insects like mosquitoes, contribute to global mortality, causing over a million deaths annually (Aminuwa *et al*., 2018). Of the approximately 20,000 known bee species, only four are of economic importance. These species are, *Apis florae* (Dwarf honeybee), *A. dosata, A. cerena* and *A. mellifera* (Western honey bee) (Ajao *et al*., 20 21). Among the four species, *A. mellifera* is the most widely distributed which have been found in Europe, Middle East, and Africa in different races (Chakuya *et al*., 2022). *A. mellifea* is a commercially managed bee species in apiaries in Nigeria (Fasasi and Alluh, 2019). *Apis mellifera* is one of the main species kept in hives in many apiaries (Hefft *et al*.,

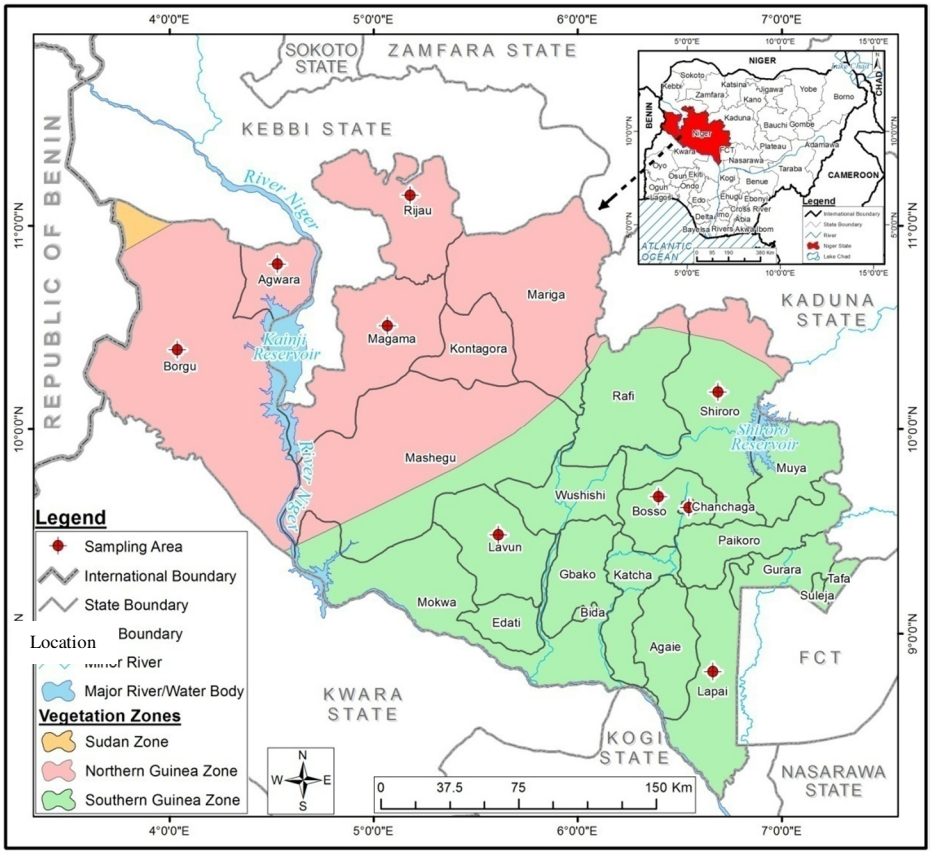


Figure 1: Map of the study area in relation to vegetation zones (Northern and Southern Guinea Savannah). Source: Map Gallery, Geography Department, ABU, Zaria, (2019).

2021). It is managed in various forms of hives depending on resources, its construction, or the local availability of durable wood (Akinlade, 2019). A beehive is an enclosed structure made in which the subgenus *Apis* lives and raises their young. Apiary is regarded as a place where beehives, bee artificial nesting homes are provided by humans, in the form of boxes of specific dimensions for keeping and raising bees for their honey. The structure varies according to location and needs (Adeyemi *et al*., 2021).

There have been several reports on the healing effects of Nigerian honey on burns and wounds, as well as its chemical and physical properties (Mokhtari *et al*., 2019; John-Isa *et al*., 2019; Nweze *et al*., 2020; Hossain *et al*., 2020; Jafar *et al*., 2020; Ajobiewe *et al*., 2022; Adeyemi *et al*., 2023). Additionally, numerous studies worldwide have documented the physicochemical, microbial, and medicinal properties of honey (Nguyen *et al*., 2019; Zarei and Alijani, 2019; Bobis *et al*., 2020; Berhanu *et al*., 2022). In Nigeria, the consumption of honey as a food product has significantly increased in recent years. However, there is limited data available on apicultural practices and bee species identification related to honey production in Niger State. Therefore, this study aims to provide insights into honey harvesting, processing, and bee species identification in the region.

MATERIALS AND METHODS

Study area

Niger State is located in the North-Central part of Nigeria with Minna as its capital. It is bounded to the South by the River Niger and by the States of Kebbi and Zamfara to the North, Kaduna to the Northeast, Kogi to the Southeast, Kwara to the South and Abuja is on the Eastern border . Niger State lies on the geographical coordinates of $3^{\circ}35'$ 7.33″ N $7^{\circ}23'17.41''$ N and $8^{\circ}10'58.82''$ E 11° 22′ 23.87″ E covering an estimated land area of 76,363 km^2 (29,484 m^2) and has twenty five (25) Local Government Areas having two vegetation zones as presented in (Figure 1).

The Northern Guinea Savanna vegetation is characterized by annual rainfall of 1,200mm, open

woodland and grass plains. Trees are sparse and tend to be small and stunted, with scattered shrubs and herbs. Grasses are abundant and the most dominant species include Guinea grass, Rhodes grass, and red oat grass (Adenle *et al*. 2020). The Southern Guinea Savannah vegetation with rainfall of 1.600mm is more densed and consists of taller trees, shrubs, and herbs. The most dominant plant species include baobab, shea trees, locust bean, and leopardwood. Grasses are less abundant, but some of the common species include elephant grass, Guinea grass, and red oat grass (Adenle *et al*. 2020).

Determination of apicultural and honey processing practices

The apicultural (bee keeping), honey harvesting and processing practices among apiculturists and honey retailers in the Northern Guinea Savannah (Agwara, Borgu, Rijau and Magama) Local Government Areas and Southern Guinea Savannah (Lavun, Bosso, Chanchaga, Lapai and Shiroro) Local Government Areas of Niger State were determined by administering a well-structured questionnaire. To those who could neither read nor writes, oral interview was conducted based on the questionnaire.

Bees' identification

Samples of worker bees were collected randomly from hive colonies in the two vegetation zones of Niger State. Fifty five and fifty six specimens were collected from hives in the Northern and Southern Guinea Savannah zones respectively; the collection was done with the assistance the farmers in the sampling area. The bee specimens were preserved in a sample bottles containing 70% ethanol. Identification was done with a dissecting binocular microscope using bee identification keys of Michener (2007) as cited by Awodiran *et al*. (2021). Main features considered were; (Long hairs present on the eyes, pollen basket on the hind leg and abdominal stripes of colours ranging from light orange to dark brown or black). The bee specimens were also compared with reference bee species samples available in J. C. Deeming Museum, Institution of Agricultural Research, Ahmadu Bello University, Zaria.

RESULTS

Honey harvesting and processing practices

The response of respondents to question asked for the types of hive used were local hive (51.90%) as against modern hives (48.10%) is given in (Figure 2). A preponderance of farmers extracted honey by the use of smokers 63% while 37% use fire; none used chemicals

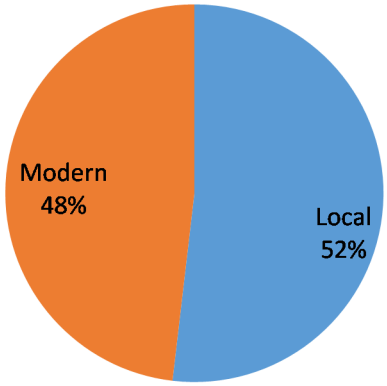


Figure 2: Types of hives used by the honey farmers.

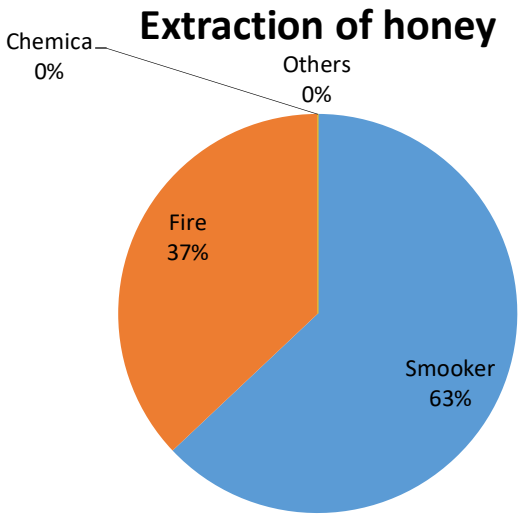


Figure 3: Methods of honey extraction of honey from hives

(Figure 3). It was also observed that 37% of the farmers used metal, 33.30% used wood while 29.70% used wood and metal as tool for extraction (Figure 4). To avoid honey contamination, 63% practice hand washing while 37% used hand glove (Figure 5). Majorly of the farmers washed their hands before extraction (88.90%), while 11.1% do not wash their hands before extraction (Figure 6). Majority of the farmers (67%) use water only, 18% water and soap while 15% used water, soap and disinfected for washing their hands (Figure 7). Furthermore, 85% washed their containers before pouring honey into it while 15% do not wash (Figure 8). All the farmers did not incorporate additive to honey (Figure 8). Forty five percent (45%) of the farmers were using used containers for storing honey, 33% used metal

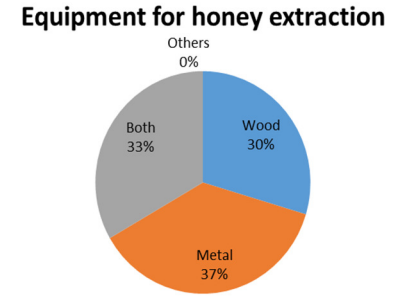
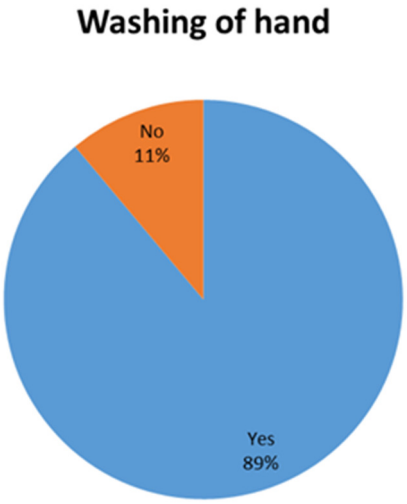


Figure 4: Equipment used for honey extraction from hives



Fig**ure 5:** Hand washing practice during honey processing by the farmers.

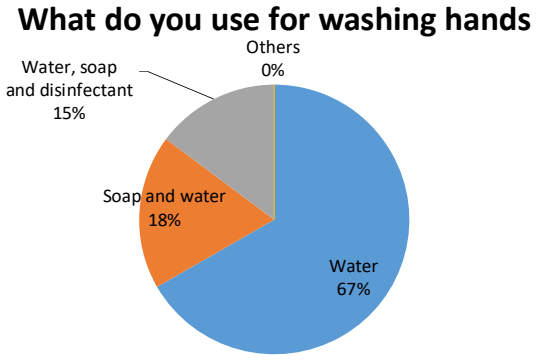


Figure 6: Items used for washing of hands by the farmers during honey processing.

containers and 22% used new plastic containers (Figure 9).

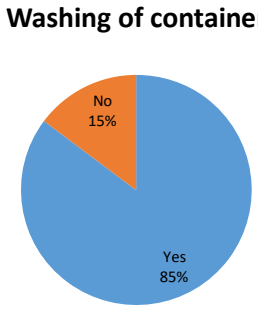


Figure 7: Level of Washing Container used for Honey Processing.

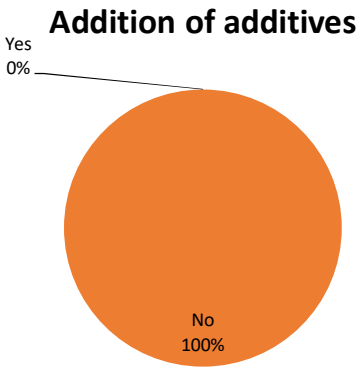


Figure 8: Level of addition of additives to honey by farmers.

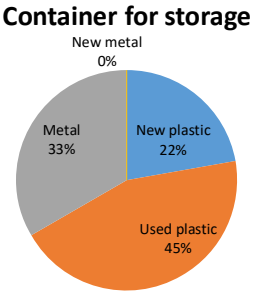


Figure 9: Types of Container used for Storage/Keeping Honey by Farmers

Bees species Identification from the Northern and Southern Guinea Savannah Zones

All the bee samples collected (53 from North, 56 from

Table 1: Analysis responds of the questionnaire conducted on the honey farmers.

Question	Frequency	Response (%)
1:Gender		
a- male	24	88.9
b- female	3	11.1
Total	27	100
2:Age group		
a-21-30	0	0.00
b-31-40	0	0.00
c-41-50	7	25.9
d-51-60	13	48.1
e-61-70	7	25.9
Total	27	100
3:Level of Education		
a- Primary	5	18.50
b- Secondary	9	33.33
c- Tertiary	5	18.50
d- Postgraduate	5	18.50
e- None (illiterates)	3	11.10
Total	27	100
4: Duration in honey business		
a- 1-5 years	1	3.7
b- 6-10 years	17	63.00
c- 11-20 years	9	33.30
Total	27	100.00
5: Location of Hives		
a- Farm	11	40.7
b- Home back yard	0	0.00
c- In the wild	16	59.30
Total	27	100
6: Type of Hive		
1- Local	14	51.90
2- Modern	13	48.10
Total	27	100
8: Bees control		
a- smoker	17	63.00
b- fire	10	37.00
c- chemical		
d- others		
Total	27	100
9: Equipment for extraction		
a- wood	8	29.70
b- metal	10	37.00
c- both	9	33.30
Total	27	100
10: Measures used in processing		
a- Gloves	10	37.00
b- Hand washing	17	63.00
c- Head cover		
Total	27	100
11: Hand washing		
a- Yes	24	88.9
b- No	3	11.10
Total	27	100
12: What is it used for.		
a- Water only	18	66.70
b- Soap and water	5	18.50
c- Water, soap and disinfectant	4	14.80
Total	27	100
13: Washing a container		
a- Yes	23	85.20
b- No	4	14.80
Total	27	100

South) were all *A. mellifera*.

DISCUSSION

As shown in (Table 1), the findings from study shows that majority of honey farmers (88.9%) are males, this finding is similar to that of Onwubuya (2004) and Matanmi *et al*. (2008) that reported that majority of honey harvester in Nigeria were males. The reason behind the lower proportion of female honey farmers might be due to the conventional stinging of the bees which is too high a risk, hence reducing women's participation (Agbelemoge and Adekola, 2020).

Also majority of farmers are more than 50 years of age.

Table 1: Contd.

14: If yes what do you use	**Frequency**	**Response (%)**
a- Soap	12	44.40
b- detergent	0	0.00
c- Water, soap, detergent	0	0.00
d- other	15	55.60
Total	27	100
15: Method of process from comb		
a- filtration	21	77.80
b- hand pressing	6	22.20
c- heating		
Total	27	100
16: Additive to honey		
a- Yes	0	0.00
b- No	27	100
Total	27	100
19: Specific day of extraction		
a- Yes	12	44.40
b- No	15	55.60
Total	27	100
20: Pest and disease control		
a- chemical	0	0.00
b- fire	3	11.10
c- picking	9	33.30
d- physical killing	15	55.60
Total	27	100
21: contain the store honey		
a- new plastic container	6	22.20
b- used plastic container	12	44.40
c- metal container	9	33.30
Total	27	100
22: How do you sell		
a- Hawking	3	11.10
b- Market	8	29.60
c- Home	5	18.50
d- Roadside	8	29.60
e- Schools	0	0.00
f- others	3	11.10
Total	27	100
23: People that buy		
a- Individuals	23	85.20
b- Traders	1	3.70
c- Others	3	11.10
Total	27	100

The finding is not in line with the findings of Farinde *et al*. (2005), who found out that larger proportion (73.8%) of honey farmers were between the age of 21-50 years of age, also, Agbelemoge and Adekola, (2020) obtained (55.5%) which were below the age of 51-60years of age. The level of education of the honey farmers in this study shows that the larger proportion of the farmers that participated in the study were educated people, which stimulate their acceptance of improved technology.

This study is in line with the work of Adebelemoge and Adekola (2000); Onemolease (2005) and Natukunde *et al*. (2011) that discovered that majority of farmers had one form of formal education or the other. Being in mind that experience is the best teacher, most of them had between 6-20 years of experience of honey farming. Findings from this study also shows that 63% of the respondents had experiences of 6-10 years in beekeeping, this indicated that majority of the beekeepers in the study area had the prerequisite experience to be successful in the business. This is consistent with the findings of vaziritabar and Esmaeilzade (2016) in karaj state, Iran, which reported 85% of their beekeepers had experience of 6-10 years. In addition, Ijigbede (2017) in Ondo state reported 80% of beekeeper had 8-18 years of experience in bee farming.

The study showed that 51-90% of the beekeepers made use of traditional techniques in honey production Traditional methods are generally associated with high level of microbial contamination and also low honey yield, poor marketability and destruction of bee population (Ajao *et al*., 2021). This is in line with the findings of Adedeji *et al*. (2016), who r eported that 60% of the

Table 2: Bees species identified from the two Guinea savannah zones

Vegetation type	Bee species	Number
Northern Guinea Savannah	*Apis mellifera adansonii* L. (1804)	53
Southern Guinea Savannah	*Apis mellifera adansonii* L. (1804)	56

beekeepers make use of traditional hives for beekeeping. The data obtained from the identification of bees' species obtained from this study showed that, all the bees belong to the species *Apis mellifera adansonii* L. (Ajao *et al*., 2021) which has remained the sole honey producing species in Nigeria and some African countries (Table 2).

Conclusion

In conclusion, this study highlights key challenges and opportunities in Nigerian honey farming. The sector is dominated by older male farmers, with low female participation due to risks like bee stings. While most farmers are educated and open to adopting new technologies, traditional methods still limit productivity and honey quality. Increased access to modern techniques could improve yields and marketability. The study also confirms that *Apis mellifera adansonii* L. is the dominant bee species. To ensure growth in the honey industry, targeted interventions for younger farmers and modern beekeeping practices are essential.

Acknowledgements

The author(s) would like to express sincere gratitude to Mr. Abuh Yahaya for his generous financial support, which made this research possible. The author(s) also extend heartfelt thanks to the bee farmers for their cooperation and to the Association of Bee Farmers, Niger State, for their invaluable assistance throughout the study. Their collective support and contributions were instrumental to the success of this research

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