

**INVESTIGATION OF PLANTS OF SPICE VALUE IN SELECTED  
MARKETS WITHIN BENIN CITY, EDO STATE, NIGERIA**

**BY**

**Priscilla Abieyuwa OMOROSE (Miss)  
AGR2000133**

**DEPARTMENT OF FOREST RESOURCES AND WILDLIFE  
MANAGEMENT  
FACULTY OF AGRICULTURE  
UNIVERSITY OF BENIN  
BENIN CITY, NIGERIA**

**NOVEMBER, 2025**

**INVESTIGATION OF PLANTS OF SPICE VALUE IN SELECTED  
MARKETS WITHIN BENIN CITY, EDO STATE, NIGERIA**

**BY**

**Priscilla Abieyuwa OMOROSE (Miss)  
AGR2000133**

**A PROJECT SUBMITTED TO THE DEPARTMENT OF FOREST  
RESOURCES AND WILDLIFE MANAGEMENT, FACULTY OF  
AGRICULTURE, UNIVERSITY OF BENIN, BENIN CITY,  
IN PARTIAL FULFILLMENT OF THE REQUIRMENT FOR THE  
AWARD OF BACHELOR OF AGRICULTURE (FOREST RESOURCES  
AND WILDLIFE MANAGEMENT) DEGREE OF THE UNIVERSITY OF  
BENIN, BENIN CITY, NIGERIA**

**NOVEMBER, 2025**

## CERTIFICATION

This is to certify that Priscilla Abieyuwa OMOROSE with Matriculation Number AGR2000133 of the Department of Forest Resources and Wildlife Management, Faculty of Agriculture, University of Benin, Benin City, carried out this research work.

---

**Dr. O.S. Ikponwonba**  
Project Supervisor

---

**Date**

---

**Dr. (Mrs) N. Osadolor**  
Head of Department

---

**Date**

## **DEDICATION**

This work is dedicated to God Almighty and also to my family and loved ones, whose unwavering support, encouragement, and patience have been my greatest motivation throughout this journey. Special thanks to those who believed in me even when I doubted myself, your faith made all the difference.

## ACKNOWLEDGEMENTS

First and foremost, I give all thanks to God Almighty for the strength, wisdom, and good health that enabled me to successfully complete this project.

My profound gratitude and acknowledgement to my supervisor Dr. O. S. Ikponwonba for his continuous guidance, constructive feedback, and encouragement throughout the course of this work. His insightful supervision greatly shaped the direction and quality of this project.

My sincere appreciation goes to the Dean Faculty of Agriculture Prof. C. O. Emokaro, Head of Department of Forest Resources and Wildlife Management, Dr. (Mrs.) N. Osadolor and my lecturers particularly, Prof. D.N. Izekor, Prof. (Mrs.) M. I. Ikhatua, Prof C.P. Kalu, Prof. O.T. Aremu, Prof. (Mrs) E.G. Oboho, Prof. G.U. Emelue, Prof. E.M. Isikhuemen, Prof A. Erakhrumen, Dr. Z. Dododawa, Dr. F. E. Osayimwen and Mr. Y. I. Egonmwan for their support, encouragement, advice and immense contribution to acquisition of knowledge.

My profound appreciation also goes to my parents Mr. Robert Omorose and Mrs. Stella Omorose and to my siblings, Engr. Sylvester Omorose, Mrs. Vivian Edieya, Mrs. Doreen Isere, Bar. Elvis Omorose, Engr. Lucky Omorose. Further thanks to my friends for their unwavering support, motivation, and understanding throughout this academic journey. Their encouragement gave me the strength to push through every challenge.

Finally, I appreciate everyone who contributed in one way or another to the successful completion of this project. Your support is truly valued.

## TABLE OF CONTENT

	<b>PAGE</b>
COVER PAGE - - - - -	i
TITLE PAGE - - - - -	ii
CERTIFICATION - - - - -	iii
DEDICATION - - - - -	iv
ACKNOWLEDGEMENTS - - - - -	v
TABLE OF CONTENT - - - - -	vi
LIST OF TABLES - - - - -	ix
LIST OF FIGURES - - - - -	x
LIST OF PLATES - - - - -	xi
ABSTRACT - - - - -	xii
<b>CHAPTER ONE</b>	
1.0 INTRODUCTION - - - - -	1
1.1 Background of the study - - - - -	1
1.2 Statement of Problem - - - - -	2
1.3 Justification - - - - -	3
1.4 Objectives of the Study - - - - -	4
<b>CHAPTER TWO</b>	
2.0 LITRATURE REVIEW- - - - -	5
2.1 Plant Spice Crops - - - - -	5
2.2 Utilization of Spice Crops - - - - -	5
2.3 Description of some Spice Crops - - - - -	8
2.4 Ethnomedical Uses of some Spices - - - - -	9

2.5	Economic significant of some Spices	-	-	-	-	-	-	-	10
2.6	Traditional and Cultural relevance of Spices	-	-	-	-	-	-	-	10
2.7	Cultivation practices of Spice Crops	-	-	-	-	-	-	-	10
2.8	Market Dynamics and consumer preferences of Spices	-	-	-	-	-	-	-	11
2.9	Forest Plants of Food Spices	-	-	-	-	-	-	-	11
2.10	Medicinal Plants Spices	-	-	-	-	-	-	-	12
2.11	Deforestation and Agricultural practices	-	-	-	-	-	-	-	12
<b>CHAPTER THREE</b>									
3.0	<b>MATERIALS AND METHODS</b>	.	.	.	.	.	.	.	14
3.1	Description of Study Area	.	.	.	.	.	.	.	14
3.2	Methodology	.	.	.	.	.	.	.	16
3.3	Data Collection	-	-	-	-	-	-	-	17
3.4	Data Analysis	.	.	.	.	.	.	.	19
<b>CHAPTER FOUR</b>									
4.0	<b>RESULTS AND DISCUSSION</b>	-	-	-	-	-	-	-	21
4.1	RESULTS	-	-	-	-	-	-	-	21
4.1.1	Socio-Economic Characteristics of Spice Traders	-	-	-	-	-	-	-	21
4.2	Plant Crops of Spices Value	-	-	-	-	-	-	-	23
4.3	Economic value of Forest spice crops	-	-	-	-	-	-	-	26
4.4	Barriers faced by Plant Spice Traders	-	-	-	-	-	-	-	33
4.5	DISCUSSION	-	-	-	-	-	-	-	34
<b>CHAPTER FOVE</b>									
5.0	<b>CONCLUSION AND RECOMMENDATION</b>	-	-	-	-	-	-	-	37
5.1	CONCLUSION	-	-	-	-	-	-	-	37

5.2	RECOMMENDATION	-	-	-	-	-	-	-	38
	<b>REFERENCES</b>	.	.	.	.	.	.	.	45
	Appendix 1: Research Questionnaire							-	51
	Appendix 2: ANOVA for Price of Spice							-	49
	Appendix 3: Average Price of some Spice Plants sold for the past three (3) years							-	50

## LIST OF TABLES

	<b>PAGE</b>
<b>Table 1:</b> Gps Location of Investigated markets - - - - -	16
<b>Table 2:</b> Socio-demographic Characteristics of Respondents in Benin Metropolis -	22
<b>Table 3:</b> Percentage and Use Value of Spice Plants - - -	27
<b>Table 4:</b> Mean separation of Spice Plants for the past three (3) years - -	31

## LIST OF FIGURES

<b>Figure 1:</b> Map of Edo State showing Study Area	-	-	-	-	15
<b>Figure 2:</b> Distribution of Respondents	-	-	-	-	23
<b>Figure 3:</b> Parts of Spice Species Used	-	-	-	-	24
<b>Figure 4:</b> Form of Spice Species Sold	-	-	-	-	24
<b>Figure 5:</b> Difficulties faced in selling Spice Species	-	-	-	-	33

## LIST OF PLATES

	<b>PAGE</b>
<b>Plate 1:</b> Interviewing a spice trader at New Benin market - - - -	18
<b>Plate 2:</b> Interviewing forest spice plant vendor at Ekiosa market - - - -	18
<b>Plate 3:</b> Observed forest spice plants at Uselu market - - - -	18
<b>Plate 4:</b> Fruits of <i>Tetrapleura tetraptera</i> - - - -	25
<b>Plate 5:</b> Rhizomes of <i>Zingiber officinale</i> - - - -	25
<b>Plate 6:</b> Seeds of <i>Parinari excels</i> - - - -	25
<b>Plate 7:</b> Bark of <i>Cinnamomum verum</i> - - - -	25
<b>Plate 8:</b> <i>Monodora myristica</i> (Ikposa) - - - -	29
<b>Plate 9:</b> <i>Aframomum melegueta</i> (Ehien-edo) - - - -	29

## ABSTRACT

This research examined the plants of spice value sold in selected markets within Benin City, Edo State, Nigeria, to identify the species in trade, their socio-economic importance, and the challenges faced by traders in the spice market. The study was conducted across seven purposely selected markets: Ekiosa, Oregbeni, Oliha, Oba, New Benin, Santana, and Uselu based on their prominence in spice trading. Data obtained through the administration of 100 questionnaires and direct market observations. Descriptive statistics, Use Value (UV), and Family Use Value (FUV) indices were employed to analyze the data. Results showed that women constituted the majority of spice traders (83%), while men accounted for 17%, indicating a female-dominated occupation. Most respondents were married (78%), with 50% aged between 41 and 60 years, and 48% possessing secondary education. A total of twenty-two (22) spice plant species belonging to fifteen (15) botanical families were identified, with the seeds and leaves being the most frequently used parts, mostly sold in dried form. Prominent spices included *Monodora myristica* (African nutmeg), *Aframomum melegueta* (alligator pepper), *Piper guineense* (black pepper), and *Xylopia aethiopica* (Ethiopian pepper), which were mainly used in the preparation of traditional dishes such as pepper soup and black soup. The Lamiaceae family recorded the highest Family Use Value (FUV = 0.701), while *Thymus vulgaris* exhibited the highest Species Use Value (UV = 2.0), indicating high cultural and culinary relevance. The study revealed that the price of spices increased significantly between 2023 and 2025 ( $p < 0.05$ ), with *Aframomum melegueta* and *Tetrapleura tetraptera* ranking among the most expensive species due to scarcity and rising demand. Major challenges reported by traders included unstable pricing (92%), high transportation costs (87%), inadequate storage facilities (35%), and seasonal scarcity (29%). These constraints negatively affected income, with most traders earning below ₦200,000 annually. The research concludes that plants of spice crops remain a vital component of household nutrition, income generation, and cultural heritage in Benin City. However, the increasing preference for modern synthetic spices and deforestation poses significant threats to their sustainability. It is therefore recommended that government and relevant agencies promote the domestication and afforestation of indigenous spice plants, improve market infrastructure, provide value addition and processing facilities, and enhance awareness of the economic and ecological benefits of conserving spice biodiversity.

## CHAPTER ONE

### INTRODUCTION

#### 1.1 Background of the study

For centuries, plants have provided invaluable resources, contributing to human livelihoods while sustaining ecological balance. Forest plants are the wealth of any nation, and they play a major role in maintaining the balance of nature. In the past, forests were maintained for the purposes of supporting wildlife and providing timber for construction and fuelwood. However, forest also provides an array of non-timber forest products (NTFPs) among which food is very prominent (Oboho *et al.*, 2016). Food is a basic necessity of life consumed to provide nutrition to the body. Although the actual quantity of food eaten from wild plants may be considered small, the nutritive value can be significant due to the essential vitamins and mineral composition they contain.

In Edo State, Nigeria, the forest plant is a source of not just timber and non-timber products, but also a variety of spices that play a significant role in local cuisine and global markets. These spices, including nutmeg, cloves, and various pepper varieties, are deeply embedded in the culture and economy of local communities (Nwafor and Ogwueleka, 2020)

Plants of spice value are naturally occurring plant species or parts of plants (seeds, leaves, roots, etc.) that are used as spices or have culinary uses. Spices are important components of food in different cultures of the world. According to Ekhosuehi (2015), a spice is an aromatic and pungent vegetable substance used to wet, appetize and season foods. Spices are popular among Nigerians, although most of the Nigerian spices grow in the wild (Awasthi and Pandey, 2016). The bulk of the spices identified in Nigeria are found in the Southern rainforest zone of the

country, while others such as garlic and ginger are found predominantly in the Northern zone (Olife *et al.*, 2013). Many spices, however, can contribute significant portions of micronutrients (e.g. Vitamin A, iron, magnesium, calcium, etc) to the diet (Olife *et al.*, 2013).

In recent years, the increasing global demand for natural flavour enhancers and health-promoting products has brought renewed interest to the cultivation of spice crops in home gardens, transforming the landscape of local agro-economics (González *et al.*, 2019). Despite the ecological richness of the forests in Edo State, the true economic potential of spice crops remains underexplored. Understanding the local economic significance and broader market dynamics is essential for sustainable agricultural practices and rural development initiatives (Ogunleye and Ogunleye, 2018). Consequently, this study aims to address these gaps by investigating the plants of spice value in selected markets in Benin City, thus providing a comprehensive analysis of its socio-economic importance and implications for socio-cultural needs of the people.

## **1.2 Statement of problem**

The sustainable management of forest resources in Nigeria faces myriad and challenges, including deforestation, climate change, and the adverse effects of unsustainable agricultural practices. While spices represent a critical component of the local forest economy, there is insufficient empirical evidence regarding their market value, production sources, and the socio-economic profiles of those who market them (Ajala and Afolabi, 2020). Many smallholders remained trapped in cycles of poverty due to their limited access to market information and barriers to entry that hinder their ability to realize the full economic benefits of spice cultivation (Ogunleye and Ogunleye, 2018). Despite the importance of spices in the socio-cultural and dietary needs of people, only very little attention has been focused on their domestication, research and conservation especially in Nigeria. Since most of the spices are still obtained from

the wild, their domestication becomes imperative in order to have sustainable production of the resource.

This study therefore sets out to investigate what is available as represented in the market/marketing survey and hence an insight into what needs to be done to protect/conservate this natural resource as well as developing strategies and policies of sustenance for this valuable resource. Oboho (2014b) was of the view that knowledge of spices is a vital step in the enhancement of its sustainability and continued use by the people.

### **1.3 Justification of the study**

Plants spice crops are not only important as timber and non-timber products but also play significant role in local cuisine and are embedded in the culture and economy of local communities.

In Edo state, the three economic potential of spice crops remained under-explored. Also, deforestation and habitat loss, farming practices as well as increasing exploitation have led to the dwindling availability of plant spice crops in our markets.

Hence, the need for investigation of ethnobotanical plants of spice value in different markets in Benin City.

### **1.4 Objectives of the study**

The main objective of this study is to investigate plants of spice value in selected markets in Benin City, Edo State, Nigeria.

The specific objectives are to;

1. examine the socio-economic characteristics of traders engaged in the marketing of these spices.
2. examine the parts of plant spice crops that are sold in the markets
3. assess the economic value of the plant spice crops in selected markets in Benin City.
4. identify challenges faced by spice traders in order to maximize the economic benefits of the traders and proffer solutions.

## CHAPTER TWO

### LITERATURE REVIEW

#### 2.1 Plant spice crops

Spice crops, defined as plants that yield aromatic properties and are used primarily for flavouring, fragrance, or medicinal purposes, play a significant role in global agriculture and trade. A spice is a dried seed, fruit, root, bark or vegetative substance used in nutritionally insignificant quantities as a food additive for the purpose of flavouring, and sometimes as a preservative by killing or preventing the growth of harmful bacteria. Spices can also be defined as “vegetable products used for flavouring, seasoning and imparting aroma in foods” (FAO, 2005).

According to Kinsella (2015), spices contribute to the flavour and nutritional profile of food while also providing health benefits, which range from anti-inflammatory to antimicrobial properties.

#### 2.2. Utilization of spice crops

In addition to making food taste good, aroma also add greatly to the pleasure of eating. Culinary spices have been used as food preservatives and for their health-enhancing properties for centuries (Kaefer and Milner, 2011). Moreover, for people of the world, spices stimulate appetite and create visual appeals to food and increase the flow of gastric juices (Opara and Chohan, 2014). Spices have great role in transforming farmers as producers for market instead of producing merely for subsistence (Dessalegn, 2015). People use spices to flavour bread, butter, meat, soups, and vegetables. They also use spices to make medicines and perfumes (ITC, 2010). Spices are needed every day in the preparation of the main dishes (Mathewos, 2016).

Spices are used traditionally in food flavouring and colouring, and are increasingly used as natural preservatives in active packaging (Mubeen et al., 2009). Spices also play a key role in nutrition as good sources of micronutrients and macronutrients. Ogunka-Nnoka and Mepba (2008) conducted an analysis of some Nigerian spices and found them to be fairly rich in nutrients. Many spices are good sources of calcium, phosphorus, magnesium, and micronutrients such as zinc (Adelaja, 2005).

Indigenous spices such as *P. guineense*, *X. aethiopica* and *T. tetraptera* are used generally to prepare local pepper soups, usually consumed hot before or after meals at homes or in restaurants. The use of spices in culinary predates recorded history and is said to have been an integral part of local dishes in South Asia and the Middle East as far back as 2000 BC (Tapsell et al., 2006).

In Mesopotamia, the cradle of civilization where agriculture began, there is evidence that humans were using thyme for their health properties as early as 5000 BC and were growing garlic as early as 3000 BC (Singletary, 2016). Spices are often gathered from plants when they have stopped flowering. Spices are functional foods, these are foods that can be demonstrated to have a beneficial effect on certain target functions in the body beyond basic nutritional requirements (Lobo et al., 2010). Spices occur in a variety of flavour, colour, and aroma contributing a wide range of nutrients to foods (Mann, 2011). They enhance and complement flavour in foods with no detrimental effect on the organoleptic quality of the food (Kaefer and Milner, 2011).

There are numerous advantages of spices which include health benefits such as speeding up of metabolic rate and mitigating risks of chronic inflammation. Also various spices have medicinal value for the treatment of various ailments including the treatment of stomach aches, cut/wounds, malaria, diarrhea, ulcer and others. Some of the spices used in Nigeria for food and medicine are

the following; *Parkia biglobosa*, Alligator pepper, Ginger, Garlic, Unien (*Xylopiya aethiopica*), *Piper guineense*, *Monodora myristica* (Ikposa) among others (Odukoya et al., 1999).

They make food taste good but may not be delicious themselves, and many of them possess marked pharmacological and medicinal properties (Newman and Cragg, 2012). Their constituents function as defense chemicals to repel insects, snakes, and other animals, and to kill microbes especially parasitic fungi (Adeyemi, 2011). They sometimes contain allelo-chemicals, certain plants (such as *Thymus vulgaris*) to inhibit the growth of other plant species around them (Linhart et al., 2015). The importance of spices is underscored by the fact that they are still found in 40% of drugs prescribed till date (Mann, 2011).

Spices and herbs are revered for their potential health attributes. They are reported to have positive effects in the treatment of numerous diseases, especially chronic ones such as cancer, diabetes, and cardiovascular diseases (Kaefer and Milner, 2011). That nutrition and health are intricately linked is a well-established fact, and the ability of nutrition (in this case, nutrients from spices) to reduce the risk of diseases has engaged the attention of researchers and nutritionist alike in recent decades. Numerous epidemiological, preclinical, and clinical studies providing insights into the mode of action of this relationship has been carried out (Kochhar, 2008; Krishnaswamy, 2008; Iyer et al., 2009).

The rise in demand for cheaper and safer therapeutics due to high cost and apprehension around the side effects of conventional drugs is stimulating interest in the use of phytomedicine for treatment, and management of diseases (Sigh, 2007; Dolui and Segupta, 2012).

### **2.3. Description of some spice crops**

### 2.3.1 *Piper guineense* (Oziza)

*Piper guineense* (Piperaceae) is commonly known as African black pepper, ‘Oziza’ in Benin, Edo State and ‘Iyeree’ in Yoruba south Western Nigeria. The plant is also known as Ashanti pepper, Benin pepper, Guinea pepper, and false cubeb in other parts of Africa. There are over 700 species of this plant which grows in tropical and sub-tropical Africa (Besong et al., 2016). They have prolate spheroid seeds, native to Central and West Africa, are semi-cultivated in Nigeria (Klin-Kabari, 2011). The plant is used for culinary, medicinal, cosmetics, and insecticidal purposes (Martins, 2013; Anyawu and Nwosu, 2014).

### 2.3.2 *Aframomum melegueta*

*Aframomum melegueta* belongs to the ginger family (Zingiberaceae) and is colloquially called grains of paradise (Nwaehujor et al., 2014). It is variously known locally as ose oji in Igbo, ataare in Yoruba, and cittáá in Hausa of Nigeria (Odugbemi, 2008). The plant is a perennial deciduous herb native to the tropics and grows mainly on the swampy habitats of the West African coast, characterized by a leafy stem that may be up to 1.5 m high.

### 2.3.3 *Tetrapleura tetraptera*

Seeds used in making pepper soup for newly born women to obtain their body. *Tetrapleura tetraptera* (Fabaceae), Yoruba name aridan, oshogisha in Igbo is a single-stem deciduous plant that grows on the fringe of the West and Central African rainforest zone. The fruit has four winged pods and appears green when tender but shiny, glabrous, dark-purple-brown when mature and ripened (Uyom et al., 2013; Adesina et al., 2016). The fruit consists of a fleshy pulp with small, brownish-black seeds and possesses a characteristically pungent aromatic odour, which contributes to its insect-repellent property (Adetunji, 2007). Two of the fruit’s wings are

woody, whereas the other two are filled with soft, oily, and aromatic sugary pulp. The seeds, which rattle in the pods, are small, black, hard, flat, about 8-mm long, embedded in the body of the pod, which does not split open.

#### **2.4 Ethnomedicinal uses of some spices**

In medicine, the seeds of *A. melegueta* are employed as a local remedy for stomach ache, snakebite, diarrhea, cardiovascular diseases, diabetes, and inflammation (Ilic et al., 2010). In the Igbo culture of Eastern Nigeria, alligator pepper is chewed alongside kola nut where the hot spicy taste of the former attenuates the astringent taste of the latter. The seeds are also used in preparing yam pottage for newly born mothers to enhance appetite and reduce the risk of puerperal infections in most parts of Southern Nigeria (Dike and Ahamefula, 2012).

*P. guineense* parts are widely used in South East Nigeria for its nutritional and medicinal properties (Ekanem et al., 2010). The plant is used as a spice for its pungent and flavouring characteristic for soup preparation, for post-parturient women (Chiwendu et al., 2016). In the South Eastern parts of Nigeria, the seeds are prescribed for women after childbirth to enhance uterine contraction enabling expulsion of the placenta and other remains from the womb (Ekanem et al., 2010). The oil distillate from the seeds is used in perfumery and for soap making. The leaves are used to regulate menstrual cycle and as an ingredient in remedies for female infertility (Iwu, 2014). The root and fruits are incorporated in remedy for sexually transmitted diseases, especially gonorrhoea and syphilis (Iwu, 2014).

Orwa et al. (2009) noted that every part of the *Tetrapleura tetraptera* plant has found use in one industry or the other. The fruit pulp is rich in sugars and may be used in flavouring food; the fairly hard heartwood and white sapwood are used in timber, its tannin is used as a dye and in

medicine, extracts of the leaves, bark, roots, and kernel has been exploited as medicines. Also, the fruit and flowers are used as perfumes (Ngassoum et al., 2001; Adetunji, 2007).

## **2.5 Economic significance of spices**

The economic significance of spice crops cannot be overstated. They contribute substantially to the agricultural GDP of many countries, particularly in developing nations. In Nigeria, the spice industry has shown potential for improving local economies, as reported by the Food and Agriculture Organization (FAO, 2020). The authors emphasize that spices not only generate income for farmers but also create job opportunities in processing, marketing, and distribution.

## **2.6 Traditional and cultural relevance of spices**

Spices have profound traditional and cultural importance, especially in Nigerian societies where they are integral to culinary practices. Each community has unique spice varieties that reflect local tastes and heritage (Ilori & Taiwo, 2021). The use of spices in religious and cultural ceremonies further underscores their significance; as noted by Akinmoladun et al. (2018), spices often form part of traditional medicine, playing a role in various cultural rituals, beliefs and ceremonies.

## **2.7. Cultivation practices of spice crops**

The cultivation of spice crops in Nigeria has evolved over the years. According to Ibrahim et al. (2021), many spice-producing regions still rely on manual, labour-intensive farming, which may not always yield optimal results. Conversely, contemporary methods, including the use of hybrid seed varieties and integrated pest management, offer avenues for enhancing productivity. Adequate land management practices are vital for sustaining soil fertility and optimizing yield.

## **2.8 Market dynamics and consumer preferences of spices**

Market dynamics for spice crops can be complex and varied, influenced by factors such as supply and demand, quality, and geographical considerations. As noted by Ojo et al. (2022), the urbanization of cities like Benin City has led to an increased demand for diverse spices, boosting market opportunities for farmers and traders. However, the authors also note inherent challenges, including poor infrastructure, lack of market information, and price fluctuations that affect profitability. Consumer preferences for spice crops are increasingly shaped by health consciousness, culinary diversity, and the desire for organic products. Research by Tayo et al. (2020) suggests that Nigerian consumers are becoming more discerning, often favouring spices that are naturally cultivated over those treated with chemicals. Such preferences impact purchasing behaviour in local markets and may affect trends in the types of spice crops cultivated.

## **2.9 Forest plants of food spices**

Nigeria is blessed with many forest plant spices. A large number of forest plants of food spices are from the natural environment especially in the high forest belt of Nigeria.

Most of the forest plants food are collected from the wild, while some occur in low corresponding domestication gardens and low in isolated farmlands without outlying farms or scattered farm tree system. Their edible portions can be in form of nuts, seeds, leafy vegetables, fresh fruits, oils and spices. The forest plant food made vital contribution to Nigeria food and significant nourishment to their diet.

Many of the forest food species found in Nigeria have been documented by various authors (Okafor 1981, Okigbo 1993, Akachukwu 1996). However, many of these spices have become

threatened, endangered or extinct as a result of deforestation or habitat destruction. Trees from the forest that produce edible fruits of economic importance can be found in different ecological zones in Nigeria.

Some of the leaf spices used in the preparation of soups are regarded as special delicacies in some ethnic groups in Nigeria. Examples include; *Vitex doniana*, *Adasonia digitata*, *Bombax spp*, *Moringa oleifera*, *Gnetum africana* etc.

### **2.10 Medicinal plant species**

The forest is generally regarded as the richest drug store. Forests have served as sources of medicine to humans for generations. It is generally believed that all plants are medicinal and for every health disorder, there is always a plant (Adebisi, 1999)

### **2.11 Deforestation and agricultural practices**

Deforestation is caused by a number of factors of which the first is the need for new land to support farming activities. According to FAO, nearly 80% of global deforestation are said to be caused by expansions in agriculture (Gimah and Bodo, 2019). The constant destruction of our forests threatens biodiversity, decreases carbon absorption, magnifies natural disaster damage and disrupts water cycle as well as affects the availability of spice crops.

Agricultural practices especially the type practiced in the developing countries increases deforestation and habitat loss (Bodo and Gimah, 2019a). The degradation of the forest does not happen suddenly (like an earthquake) but a gradual process that may take a long period of time before it is visibly ascertained complying that the forest degrades over time. When a particular forest land is destroyed through agricultural practices, the spice plants therein are equally

destroyed and not available for further collection and may go into extinction. This leads to degradation of spice plants and quality of spice plants available in our market.

Moreover, industrialization also constitutes another factor responsible for deforestation. A larger percentage of the trees making up forests; are cut down to serve as raw materials to various industries. Similarly, in most cases, the large expanse of land where industries are located were converted to land from forests.

The gradual degradation of the forest can also occur due to increased disturbance resulting in loss of forest products or the reduction of forest quality – the thickness and structure of the trees, the biological administrators that provided the biomass of plants and animals, the species variety and the heritage variety (Bode *et al*, 2021).

## CHAPTER THREE

### MATERIALS AND METHODS

#### 3.1 Study Area

The study was carried out in Benin City, Edo state (Latitude 5° 45' N and 7° 4' N and Longitude 5° E and 6° 2' E). Edo state is bordered by Kogi state in the North, Delta state in the south and by Ondo state in the west (Osayande *et al.*, 2019) (Figure 1). The Benin metropolis occupies part of three Local Government Areas (LGA), these are Oredo local government Area, Ikpoba-Okha local government Area and Egor local government Area. Benin City is bounded by Ikpoba-Okha LGA in the south-east and north-east, in the west by Oredo LGA and in the north by Egor LGA. The City has a population of 1,086,882 (CENSUS, 2006; Osayande *et al.*, 2019).

Benin City is in the tropical rainforest zone characterized by two distinct seasons: the wet season and the dry season. The wet season span from April to November while the dry season is from December to March. Average annual precipitation is between 2000mm – 2500mm with mean monthly temperature of 28°C (82.4°F). The vegetation is predominantly rainforest but urban development has drastically reduced the vegetation to secondary regrowth. (Ezemonye and Emeribe, 2014).



### 3.2 Sampling method

A reconnaissance survey was carried out to locate and identify markets within Benin metropolis where plant spice crops vendors are concentrated. Seven (7) markets out of twelve (12) markets within Benin metropolis were purposively selected: Ekiosa market, Oregbeni market (Ikpoba-Okha LGA), Oliha market, Oba market, New Benin market, Santana market (Oredo LGA) and Uselu market (Egor LGA) based on the high population of vendors/practitioners. Seventy percent (70%) sampling intensity was used to administer 100 copies of questionnaire across the seven markets: Ekiosa market (13), Oregbeni market (11), Oliha market (11), Oba market (28), New Benin market (20), Santana market (8), and Uselu market (9).

**Table 1: Gps Location of Investigated markets**

<b>MARKETS</b>	<b>GPS READINGS</b>
Ekiosa	Lat. 6° 19' 24" N and Long. 5° 38' 11" E
Oregbeni	Lat. 6° 20'56" N and Long. 5° 39' 33" E
Oliha	Lat. 6° 20' 44" N and Long. 5° 36' 33" E
Oba	Lat. 6° 20' 5" N and Long. 5° 37' 11" E
New Benin	Lat. 6° 20' 56" N and Long. 5° 37' 55" E
Santana	Lat. 6° 20' 48" N and Long. 5° 38' 24" E
Uselu	Lat. 6° 24' 32.6" N and Long. 5° 36' 51.3" E

This study focuses on selected markets within Benin City, Edo State, specifically targeting key plant spice crops such as nutmeg, cloves, and various pepper types. The research encompasses various socio-economic parameters, including traders demographics, market dynamics, and challenges faced by spice traders.

### **3.3 Data Collection**

Data on plant spice crops were collected through interviews with market traders (Plate 1) engaged in sale of plant spices (Alexiades, 1996) by administration of questionnaires (Appendix 1) and direct observation in the field (Chambers, 1994; Martin, 1995) (plates 3, 4 and 5). Information from a total of 100 respondents were documented and all reported plant spice crops were grouped by families. Species scientific name was identified with the help of Aigbokhan (2014). The data collected include informant bio-data, uses of plant spice crops, parts used, form sold and cost.



**Plate 1: Interviewing a spice trader at New Benin market**



**Plate 2: Interviewing forest spice plant vendor at Ekiosa market**



**Plate 3: Observed forest spice plants at Uselu market**

## Data Analysis

Data collected from the market traders was analysed using descriptive statistics such as charts, tables, percentage, etc. Percentage used value for each plant species was calculated as follows:

$$\% \text{ Used} = \frac{U_i}{\sum N} \times 100\%$$

Where  $U_i$  = number of respondent that used a given species

$\sum N$  = total number of respondent that used any species

## Used Value (UV)

The relative importance was calculated employing the use value (Phillips *et al.*, 1994). A quantitative measure for the relative importance of species known locally as used value (Species Use Value) is given as:

$$UV = \frac{\sum U_i}{n}$$

Where  $U_i$  = number of use report cited by each informant for a given species

$n$  = total number of informants

Also the Family Use Value (FUV) was calculated using:

$$FUV_s = \frac{\sum UV_s}{n_s} \quad (\text{Phillips and Gentry, 1993})$$

Where  $\sum UV_s$  = Sum of the use values for all species within a given family

$n_s$  = total number of species within a given family

Use values are high when there are many use-reports for a plant, implying that the plant is important and approach zero (0) when there are few reports related to its use. The use value, however does not distinguish whether a plant is use for single or multiple purposes.

## CHAPTER FOUR

### RESULTS AND DISCUSSION

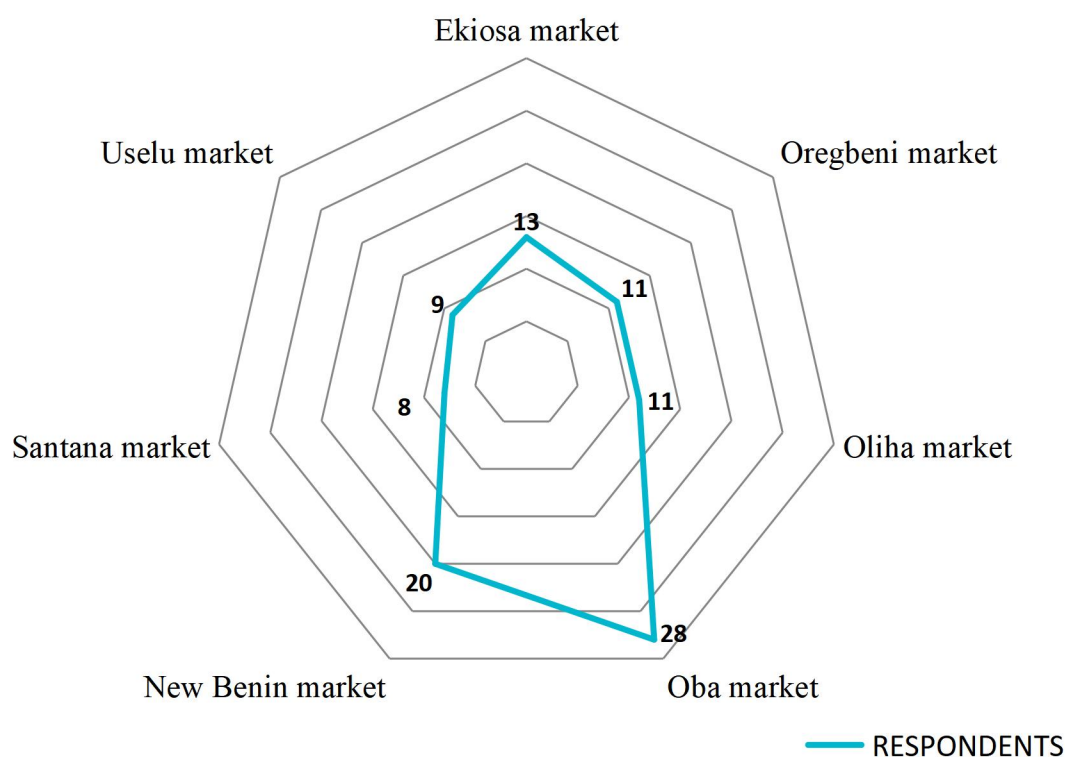
#### 4.1 Results

##### 4.1.1 Socio-Economic Characteristics of Spice Traders

The socio-demographic status of all respondents recorded in the study area is outlined in Table 2 below. The table revealed a 17% male and 83% female involved in plants of spice value of which 22 are single while 78 are married. 90% of the respondents' trade on spices only, 6% has spice crops as farm while 4% are involve in farming and selling of spice crops. The table suggest that most of the traders (50%) are matured adults (41 – 60 years) having secondary school certificate (48%) with less than 5 years' experience in the trade (28%) and a small shop space (50%) where they sell spices. Also many of the traders are traditionalist (50%) who obtained the knowledge of spice crops from their parents/relatives (45%). In the seven selected markets, there was more spice traders at Oba market (28) followed by New Benin market (20) while the least (8) was at santana market (Figure 2).

**Table 2: Socio-demographic Characteristics of Respondents in Benin Metropolis**

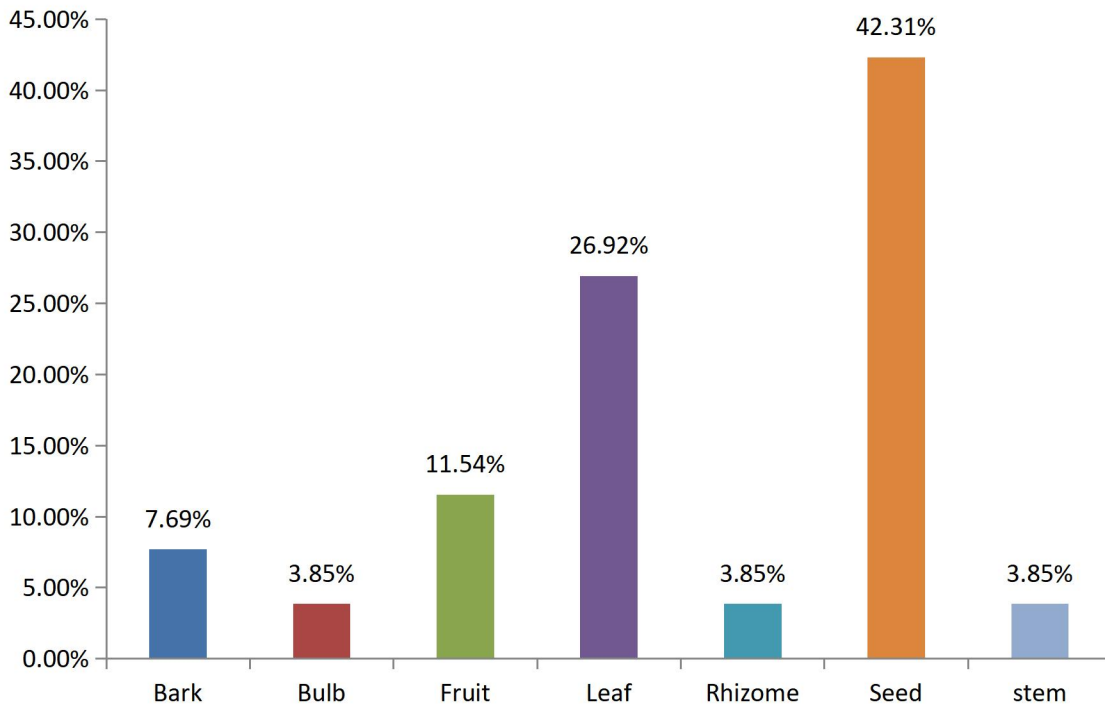
<b>Variables</b>	<b>Description</b>	<b>Frequency</b>	<b>Percentage (%)</b>
<b>Marital status</b>	Single	22	22.0
	Married	78	78.0
<b>Occupation</b>	Spice trader	90	90.0
	Spice farmer	6	6.0
	Both	4	4.0
<b>Sex</b>	Male	17	17.0
	Female	83	83.0
<b>Age</b>	< 20 years	0	0.0
	20 – 40 years	15	15.0
	41 – 60 years	50	50.0
	> 60 years	35	35.0
<b>Education qualification</b>	Primary school	36	36.0
	Secondary school	48	48.0
	Tertiary education	5	5.0
	No formal education	11	11.0
<b>Business experience</b>	< 5 years	28	28.0
	5 - 10 years	22	22.0
	> 10 years	12	12.0
<b>Religion</b>	Christianity	35	35.0
	Islamic	10	10.0
	Traditionalist	50	50.0
	None	5	5.0
<b>Shop/Store size</b>	Big	15	15.0
	Small	50	50.0
	Average	35	35.0
<b>Knowledge of spice plant</b>	Parents/Relatives	45	45.0
	Personal discovery	15	15.0
	External source	10	10.0
	Apprentice tutulage	30	30.0



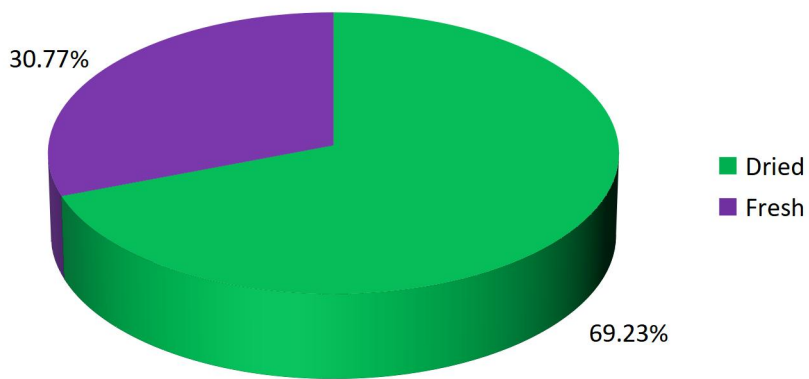
**Figure 2: Distribution of Respondents**

#### 4.2 Plant Crops of Spices Value

From the data obtained in this study, a total of 22 spice species were identified as crops used for spicing. The parts of these forest spice species used is mostly the seeds with 42.31% followed by leaves with 26.92% while parts such as rhizome, bulb and stem had the least percentage use of 3.85% each (Figure 3). The parts of spice species used are mostly sold/used in dried form (69.23%) while few are in fresh form (30.77%) as presented in figure 4.



**Figure 3: Parts of Spice Species Used**



**Figure 4: Form of Spice Species Sold**



Plate 4: Fruits of *Tetrapleura tetraptera*



Plate 5: Rhizomes of *Zingiber officinale*



Plate 6: Seeds of *Parinari excels*



Plate 7: Bark of *Cinnamomum verum*

#### 4.3 Economic value of forest spice crops

From the result presented in Table 3, a total of 22 plant spice crops belonging to 15 families were identified as used for 9 major purposes. Preparation of Pepper soup using *Monodora myristica* (Ikposa) spice (Plate 8) had the highest percentage use (7.97%), followed by the preparation of Black soup with *Aframomum melegueta* (Ehien-edo) spice (7.87%) (Plate 9). The least percentage use of 0.10% was recorded for the preparation of Jolof rice and/or Stew using *Thymus vulgaris* (Thyme) spice. The highest Family Use value (FUV) of 0.701 was recorded for Lamiaceae family while the highest species Use Value of 2.0 was recorded for *Thymus vulgaris* in the same family.

**Table 3: Percentage and Use Value of Spice Plant**

S/N	Family	Botanical name	local/common name	Use(s)	Freq.	% Use	UV	FUV
1	Amarylidaceae	<i>Allium sativum</i> L.	Garlic	Pastries, Jolof Rice	38	3.6 5	0.05 3	0.05 3
2	Apiaceae	<i>Corandrium sativum</i> L.	Omilo	Pepper soup	65	6.2 4	0.01 5	0.01 5
3	Caesalpiniodeae	<i>Hymenostegia afzelii</i> (Oliv.) Harms.	Eyinyan	Pepper soup	42	4.0 3	0.02 4	0.02 4
4	Chrysobalanaceae	<i>Parinari excelsa</i> (Oliv.) Prance	Igbafilo	Pepper soup	66	6.3 3	0.01 5	0.01 5
5	Fabaceae	<i>Tetrapleura tetraptera</i> Schumach.&Thonn	Ajo	Pepper soup	42	4.0 3	0.02 4	0.02 4
6	Icacinaceae	<i>Rhaphiostylis beninensis</i> (Hook. Jex Planck) ex Benth	Osuwanden	Banga soup	73	7.0 1	0.01 4	0.01 4
7	Lamiaceae	<i>Ocimum basilicum</i> L. <i>Thymus vulgaris</i> L. <i>Ocimum gratissimum</i> L.	Ebe-wiewa Thyme Scent leaf	Black soup Jolof Rice, Stew Black soup, Pepper soup	37 1 26	3.5 0.1 2.5 5 0 0 7	0.02 2.00 0.07	0.70 1
8	Lauraceae	<i>Cinnamomum verum</i> J.Presl.	Cinnamon	Tea	49	4.7 0	0.02 0	0.02 0
9	Moringaceae	<i>Moringa oleifera</i> Lam.	Bagaruwa	Tea	19	1.8 2	0.05 3	0.05 3
10	Myristicaceae	<i>Monodora myristica</i> (Gaertn.) Dunal	Ikposa	Pepper soup	83	7.9 7	0.01 2	0.01 2
11	Piperaceae	<i>Piper guineense</i> Schumach. & Thonn <i>Piper nigrum</i> L.	Oziza Black pepper	Pepper soup Pepper soup	81 7	7.7 0.6 7	0.01 0.14	0.07 8
12	Poaceae	<i>Cymbopogon citratus</i> (DC.) Stapf.	Lemon grass (Okain)	Pepper soup, Tea	9	0.8 6	0.22 2	0.22 2
13	Rubiaceae	<i>Heinsia crinita</i>	Beletete	Banga	72	6.9	0.01	0.01

		(Afzel.) G. Taylor		soup		1	4	3
		<i>Xylopi</i> <i>aethiopica</i>	Unien	Pepper soup	80	7.6 8	0.01 3	
14	Rutaceae	(Durand) A.Rich. <i>Zanthoxylum</i> <i>zanthoxyloides</i>	Atako,	Banga soup	8	0.7 7	0.12 5	0.10 8
		(Lam.) Zepern. & Timler <i>Citrus limon</i> (L.) Osbeck	Lemon	Drinks, Tea, Juice,	33	3.1 7	0.09 1	
15	Zingiberaceae	<i>Aframomum</i> <i>melegueta</i> Schum.	Ehien-edo K.	Pepper soup, Black soup	82	7.8 7	0.02 4	0.03 7
		<i>Aframomum</i> <i>danielli</i> (Hook f.) K. Schum	Oriema	Black soup, Pepper soup	80	7.6 7	0.02 5	
		<i>Zingiber</i> <i>officinale</i> Roscoe	Ginger	Drinks, Tea, Juice, pastries	49	4.7 0	0.06 1	
<b>TOTAL</b>		<b>22</b>			<b>9</b>	<b>1042</b>	<b>100</b>	



**Plate 8: *Monodora myristica* (Ikposa)**



**Plate 9: *Aframomum melegueta* (Ehien-edo)**

Data obtained from the respondents shows that the price of plant spice crops is high. This is buttressed by the fact that 54% respondents said the current cost of spice species is high while 37% said the cost is average and only 9% said it is low. On the other hand, the average annual income (AAI) accruable from the sale of spice species seem low; 25% respondents earn less than ₦200,000 per annum while 5% respondents make between ₦200,000 to ₦500,000 AAI and only 2% respondents get above ₦500,000 AAI. The remaining 68% respondent said their average annual income is too low to be valued as their annual income is equivalent to their annual cost.

Analysis of variance (Appendix 2) for the price of some forest spice plants sold in the markets for the past three years shows a significant difference in price within the past 3 years and within spice species ( $P < 0.05$ ). The average price of spice crops presented in Table 4 indicates that the price of spices in the year 2025 is higher (₦569.8) and significantly different from the price in year 2024 and 2023 while the cost of Ehien-edo (*Aframomum melegueta*) spice (₦588.9) is higher than/significantly different from the cost of other spices except for Ajo (*Tetrapleura tetraptera*) and Ebe-wiewa (*Ocimum basilicum*) with average price of ₦544.4 and ₦500.0 respectively (Table 4). Considering the price of plant spice crops for the past the past 3 years, the price of Ajo (*Tetrapleura tetraptera*) in year 2025 (₦1083.3) is higher and significantly different from the price of other spices within the past three years while the least price (₦100.0) is for Ikposa (*Monodora myristica*) in years 2023.

**Table 4: Mean separation of Spice plants for the past three (3) years**

YEARS	PRICE (₦)	COMMON/VERNACULAR NAME	PRICE (₦)	SPICE-YEAR INTERACTION	PRICE (₦)
2025	569.8 <sup>a</sup>	Ehien-edo	588.9 <sup>a</sup>	Ajo 2025	1083.3 <sup>a</sup>
2024	325.0 <sup>b</sup>	Ajo	544.4 <sup>ab</sup>	Ebe-wiewa 2025	800.0 <sup>b</sup>
2023	184.4 <sup>c</sup>	Ebe-wiewa	500.0 <sup>abc</sup>	Ehien-edo 2025	766.7 <sup>b</sup>
		Osuwanden	466.7 <sup>bcd</sup>	Garlic 2025	750.0 <sup>b</sup>
		Garlic	433.3 <sup>bcd</sup>	Osuwanden 2025	750.0 <sup>b</sup>
		Black pepper	400.0 <sup>cde</sup>	Black pepper 2025	700.0 <sup>b</sup>
		Cinnamon	383.3 <sup>cdef</sup>	Cinnamon 2025	700.0 <sup>b</sup>
		Igbafilo	361.1 <sup>defg</sup>	Ehien-edo 2024	650.0 <sup>bc</sup>
		Eyinyan	350.0 <sup>defgh</sup>	Igbafilo 2025	633.3 <sup>bcd</sup>
		Beletete	300.0 <sup>efghi</sup>	Eyinyan 2025	450.0 <sup>de</sup>
		Oziza	266.7 <sup>fghi</sup>	Ebe-wiewa 2024	450.0 <sup>cde</sup>
		Oriema	250.0 <sup>ghi</sup>	Beletete 2025	450.0 <sup>cde</sup>
		Scent leaf	250.0 <sup>ghi</sup>	Ajo 2024	400.0 <sup>ef</sup>
		Omilo	233.3 <sup>hi</sup>	Osuwanden 2024	400.0 <sup>ef</sup>
		Unien	216.7 <sup>i</sup>	Oziza 2025	400.0 <sup>ef</sup>
		Ikposa	211.1 <sup>i</sup>	Omilo 2025	350.0 <sup>efg</sup>
				Black pepper 2024	350.0 <sup>efg</sup>
				Ehien-edo 2023	350.0 <sup>efg</sup>
				Eyinyan 2024	350.0 <sup>efg</sup>
				Oriema 2025	350.0 <sup>efg</sup>
				Scent leaf 2025	350.0 <sup>efg</sup>
				Cinnamon 2024	300.0 <sup>efgh</sup>
				Beletete 2024	300.0 <sup>efgh</sup>
				Garlic 2024	300.0 <sup>efgh</sup>
				Igbafilo 2024	300.0 <sup>efgh</sup>
				Unien 2025	300.0 <sup>efgh</sup>
				Ikposa 2025	283.3 <sup>efgh</sup>

Osuwanden 2023	250.0 <sup>efgh</sup>
Eyinyan 2023	250.0 <sup>efgh</sup>
Garlic 2023	250.0 <sup>efgh</sup>
Ikposa 2024	250.0 <sup>efgh</sup>
Oriema 2024	250.0 <sup>efgh</sup>
Oziza 2024	250.0 <sup>efgh</sup>
Scent leaf 2024	250.0 <sup>efgh</sup>
Ebe-wiewa 2023	250.0 <sup>efgh</sup>
Omilo 2024	200.0 <sup>fgh</sup>
Unien 2024	200.0 <sup>fgh</sup>
Cinnamon 2023	150.0 <sup>gh</sup>
Ajo 2023	150.0 <sup>gh</sup>
Black pepper 2023	150.0 <sup>gh</sup>
Igbafilo 2023	150.0 <sup>gh</sup>
Oriema 2023	150.0 <sup>gh</sup>
Omilo 2023	150.0 <sup>gh</sup>
Oziza 2023	150.0 <sup>gh</sup>
Scent leaf 2023	150.0 <sup>gh</sup>
Unien 2023	150.0 <sup>gh</sup>
Beletete 2023	150.0 <sup>gh</sup>
Ikposa 2023	100.0 <sup>h</sup>

---

Means that do not share a superscript letter within column are significantly different

#### 4.4 Barriers Faced by Plant Spice Traders

Generally, 95% of the responding spice traders interviewed in the sampled markets said they experienced challenges obtaining plant spice materials while only 5% said they had no challenge. From Figure 4, the major difficulties facing the sale of spice plants in the markets is the high cost/price fluctuation as noted by 92% respondents, followed closely by distance/transportation cost with 87% respondents. Other notable difficulties faced by spice traders in selling spice plants include competition with other vendors (39%), preservation of spices (35%), seasonality/scarcity of spices (29%) and high demand of spices (29%). Over harvesting/exploitation (1%) was identified by the traders as the least difficulty they faced in selling spice species.

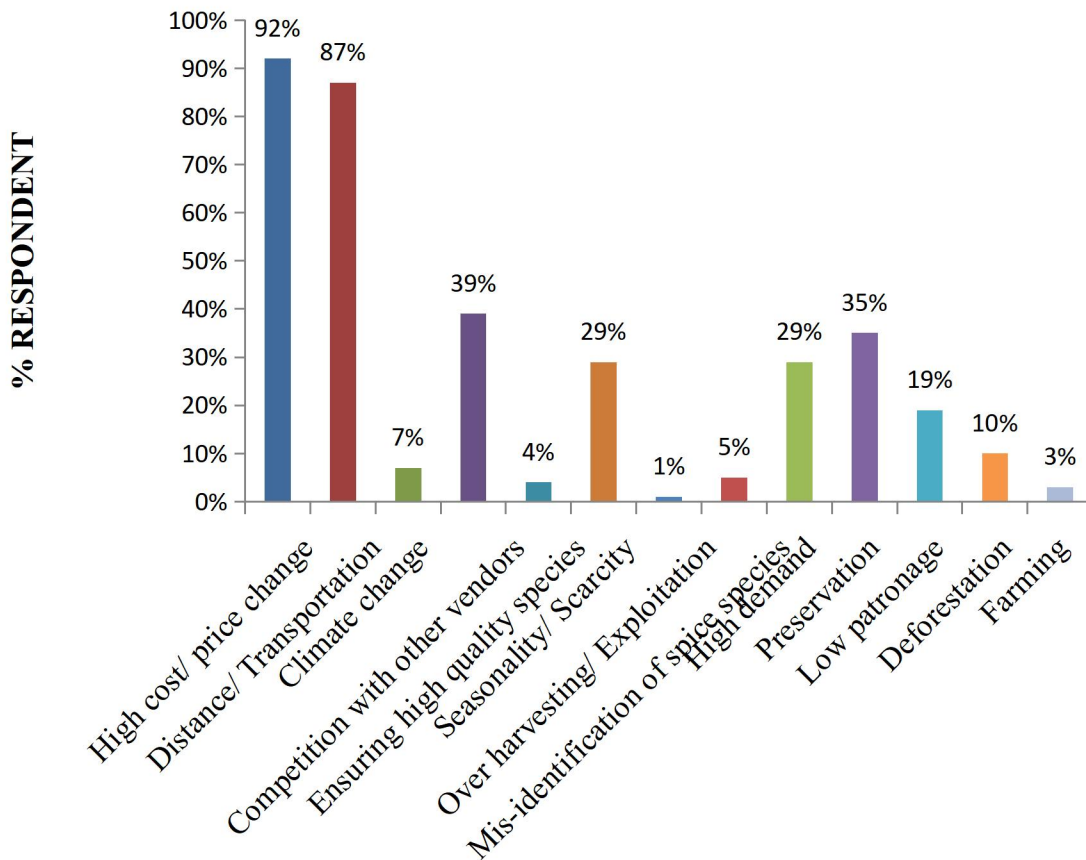


Figure 5: Difficulties faced in selling spice species

#### 4.5 Discussion

The result obtained in this study which shows high percentage of female (83%) over male (17%) involved in the sale of plants of spice value is an indication of the dominance of women in the trade. This may be due to the fact that the women have more connection with spice farmer or harvesters in the rural area who get the spices from the forest. This finding corroborate with the result obtained by Oboho *et al* (2016) who recorded 100% dominance of women in spice trading at some markets in Benin City. Similarly, Egharevba and Kalu (2004) observed that women are more engaged in the collection of NTFPs (including spices) for sustainability. Spice trading according to Oakey (2004), are activities for household food and economic stability. One reason for this gender difference may be due to the fact that many women have limited formal education which restricts them to small village-based markets.

Also the result in this study proposing the high presence of matured adults (41 – 60 years) in spice trading having secondary school certificate with less than 5 years' experience and a small shop space hint on the fact that the business of spice trading is occupied by middle aged adults with relatively high knowledge of/experience in spice species, and whom lack the financial capacity to expand their business. This agrees with the opinion of Oboho *et al* (2016) who stated spice traders are mostly middle aged and old women but disagree with their view that most of the spice traders have been in the business for over 10 years

The 22 forest spice crops belonging to 15 families identified as used for 9 major purposes in this study is not too different from the 14 spice species belonging to 10 families recognized by Oboho *et al* (2016) in their study. The high percentage use (7.97%) of *Monodora myristica* (Ikposa) spice in the preparation of Pepper soup and the use of *Aframomum melegueta* (Ehin-edo) spice (7.87%) for preparation of Black soup, could be attributed to the importance of these

species in adding flavour to the local delicacies. This finding is in line with that of Oboho *et al* (2016) who stated that the most commonly sold spices in Benin markets were *Monodora myristica*, *Aframomum spp.*, *Piper guineense* and *Xylopia aethiopica*. Egharevba (2006) also recorded five of the spices in their survey of indigenous wild fruits and condiments. The identified parts (seeds, leaves, rhizome, bulb, stem, bark and fruit) used as spice and mostly sold in dried form agree with Iwu (1998) and Mnanthar (1995) who defined spice as a dried seed, fruit, root, bark or vegetative substance primarily used for flavouring, colouring or preserving food.

The highest Family Use value (FUV) of 0.701 recorded for Lamiaceae family while the highest species Use Value (UV) of 2.0 recorded for *Thymus vulgaris* in this study. In a similar investigation, Tumoro and Maryo (2016) recorded 10 species contribution by Asteraceae family. This high number of spice species used for 9 purposes in the study area may be due to the verse knowledge of the people in the use of plants of spice value as reported by Novais *et al.* (2004). This high FUV and UV reveal the value of Lamiaceae family and *Thymus vulgaris* species for spicing and it proves the necessity of exploring such. According to Revathi *et al.*, (2013), use value is the orientation related to the usage by the people that may be high due to good result by their experience while some of them showing low use value may be due to lack of communication among the people or minimum activity in the business.

The average high price (₦569.8) of spices obtained in this study in the year 2025 compared to the year 2024 and 2023 may be due to the rising economic inflation and the high demand-supply ratio of spice products. The major difficulties facing the sale of spice plants in Benin City identified in this study as high cost/price fluctuation followed by distance/transportation cost agrees with the report of Oboho *et al* (2016) who opined that Transportation was a major

problem to spice trading because spice produce are bulky, delicate and perishable; they need to be carried carefully without crushing, moisture retention and contamination. Most of the traders use village market vehicles that are old, rickety, often over loading and breaking down. This means therefore that the conveyance of the fresh produce is prone to losses occasioned by poor transportation which impact negatively on their profit margin.

## CHAPTER FIVE

### CONCLUSION AND RECOMMENDATIONS

#### 5.1 Conclusion

The introduction of plant spices in food preparation has led to increase in use of local spices in the study area. Nowadays, young people in the study area preferred plant spices to modern spices. Most of the forest plants of spice value play vital roles in fire wood, construction work and furniture making. The multiple role of some spice plants (e.g fire wood, construction work and furniture making) other than spicing foods significantly serve as one of the threats for spice plant biodiversity conservation. The current study indicated that there is a statistical significance of the involvement in the trading of spice species between the male and the female as well as between the young and elderly. Also the high involvement of women in the business signifies the social group connected to the use of spice plants for cooking or flavouring. This aligns with the findings of Dufor *et al.* (2019), who highlight the rising global interest in spices and herbs, driven by increasing consumer awareness regarding health and nutrition.

The wide use of spices based on the high species use value (UV) and family use value (FUV) could validate the effectiveness and efficacy of spice value. For example, this study shows high use value (UV) of *Monodora myristica* (Ikposa) and *Aframomum melegueta* (Ehien-edo) spices in the preparation of Pepper soup and Black soup respectively proves the importance of these species in the local delicacies. Spices are important plant products which have not been given much silvicultural attention but have great potentials in terms of socio-cultural value in Nigeria. Plants of spice value are largely obtained from the wild, and the dominant form sold is dried spice where seeds and leaves are prominent spice parts used for flavouring food.

The study concludes that residents of Benin metropolis have good perception of plants of spice value. It is important to note that the contribution of spice crops to income varies across ecological zones/settings, seasons, income level, etc. Spice crops also contribute to achieving household food security as it has been established that a significant number of rural, tribal and overall forest dependent communities to a large extent, derive a sizable part of their food, nutrition, healthcare needs and their income from spice species. They also contribute to the well-being of spice traders, particularly the poor, in terms of income generation, food security, nutrition, health and subsistence.

## **5.2 Recommendations**

Based on the findings of this study, the following recommendations are made;

1. Facilities pertaining to storage, grading, processing and value addition through convergence of existing schemes and programs in private and public sectors should be promoted and created.
2. Traders should be empowered with information about the market, policy and products to enable them strategize and access better returns from spice products and improve transportation.
3. There is great need to enhance extension services in the aspect of private planting of spice species as well as the raising of their seedlings in nurseries for afforestation projects and home gardens.

4. The result of this findings calls for high awareness among the young and educated people in the domestication of the wild plants, cultivation and nurturing of plants of spice value in a secured environment, including home gardens and general promotion of spice plants in annual tree planting exercise.

## REFERENCES

- Adesina, S. K. , Iwalewa, E. O. , Imoh, I. J . (2016). Tetrapleura tetraptera Taub-ethnopharmacology, chemistry, medicinal and nutritional values- a review. *British Journal of Pharmaceutical Research* 12: 1–22
- Adetunji, J. A . (2007). Tetrapleura tetraptera: Molluscidal activity and chemical constituent. *African Journal of Traditional Complementary and Alternative Medicines* 4: 23–26.
- Adeyemi, M. M. H . (2011). A review of secondary metabolites from plant materials for post harvesting. *International Journal of Pure and Applied Science and Technology* 6: 94–102.
- Aigbokhan, E.I. (2014). Annotated Checklist of Vascular Plants of Southern Nigeria- a Quick Reference Guide to the Vascular Plants of Southern Nigeria: a Systematic Approach. Uniben Press, Benin City. 346p.
- Ajala, A. T. and Afolabi, S. F. (2020). The Economic Importance of Medicinal and Aromatic Plants in Nigeria. *Journal of Medicinal Plants Studies*, 8 (5): 49 - 54.
- Akinmoladun, O. F., Keshinro, O. M., & Akinlosotu, T. A. (2018). Cultural implications of spices in Nigeria: A review. *Journal of Ethnic Foods*, 5(1), 12-20.
- Alexiades, M.N. (1996). Selected Guidelines for Ethnobotanical Research: A Field Manual. The New York Botanical Garden, New York, pp. 99-133.
- Anyawu, C. U. , Nwosu, G. C . (2014). Assessment of the antimicrobial activity of aqueous and ethanolic extract of Piper guineense leaves. *Journal of Medical Research* 8: 337–439.
- Awasthi, K.K. and Pandey, A. (2016): Utilization of traditional herbs, spices, seasoning and condiments: A case study of the preparation of “Buknu” in selected villages of Kanpur, Uttar Pradesh, India. *European Journal of medicinal plants*, 14 (1): 1 - 11.
- Chambers, R. (1994). Participatory Rural Appraisal (PRA): Analysis of experience. *World Development*, 22(9): 1253-1268.
- Chiwendu, S. , Ejike, E. N. , Ejeke, B. U. , Oti, W. , Uwachukwu, I . (2016). Phytochemical properties of Uziza leave (Piper guineense). *Journal of Pure and Applied Chemistry* 3: 12–15.
- Dessalegn Gachena. 2015. Analysis of Factors Determining the Supply of Ethiopian Cardamom Spice (*Aframomum corrorima*): A Case from Bench Maji Zone of SNNPR, Ethiopia. *European Journal of Business and Management*, 7 (1): 56-63.
- Dike, M. C. , Ahamefula, N. E . (2012). Comparative study of proximate, phytochemical and mineral compositions of edible plant fruits/seeds from Nigerian rainforest. *International Journal of Biology and Chemical Sciences* 6: 1905–1909.

- Dolui, A. K. , Segupta, R . (2012). Antihyperglycemic effect of different extracts of leaves of *Cajanus cajan* HPLC profile of the active extracts. *Asian Journal of Pharmaceutical and Clinical Research* 5: 116–119.
- Dufour, D. R., Monteleone, D. M., & Thys, E. S. (2019). The economic health benefits of global spice consumption. *Food Research International*, 116, 14-27.
- Egharevba, R.K.A (2006). Economic empowerment of women through horticultural crop production and innovative cottage industries. Guest speakers address at the 24th conference of the Hort. Society of Nigeria, Gombe, 17th – 22nd. In Hortson proceedings 24: 7 – 14.
- Egharevba, R.K.A. and Kalu, C. (2004). Economic empowerment of women through NTFPs. *Nigeria Journal of Applied Science Vol.22*: 198 – 204.
- Ekanem, A. P. , Udoh, V. F. , Oku, E. E . (2010). Effects of ethanol extract of *Piper guineense* seeds (Schum and Thonn) on the conception of mice (*Mua Musculus*). *African Journal of Pharmacy and Pharmacology* 4: 362–367.
- Ekhosuehi, A.O. (2015): Spice preserving culture. *The Evangelist*, pg.15
- Ezemonye, M.N. and Emeribe, C.N. (2014). *Mediterranean Journal of social sciences*, 5(1): 547. Dol: 10.5901/mjs.2014 v5 nlp 547.
- FAO (Food and Agriculture Organization). 2005. Herbs, spices and essential oils: post-harvest operations in developing countries, by M. Douglas, J. Heyes & B. Smallfield, Rome.
- FAO (2020). Nigeria spice crop production status report. Food and Agriculture Organization. Retrieved from [FAO website](<http://www.fao.org>).
- FAO. (2021). The State of Food and Agriculture 2021. Food and Agriculture Organization of the United Nations.
- González, C. Pimentel, G. and Vera, D. (2019). The Role of Spices in Sustainable Food Systems. *Sustainability*, 11(14), 3909.
- Ibrahim, K. A., Adeyemo, A. O., & Agboola, J. K. (2021). Modern agricultural practices and spice crop yield in Nigeria: A review. *Journal of Agricultural Science*, 13(2), 45-56.
- Ilic, N. , Schmidt, B. M. , Poulev, A. , Raskin, I . (2010). Toxicological evaluation of grains of paradise (*Aframomum melegueta*) [Roscoe] K. Schum. *Journal of Ethnopharmacology* 127: 10–17.
- Ilori, M. O., & Taiwo, O. (2021). Spices and their roles in Nigerian culture: A socio-cultural approach. *Cultural Studies Journal*, 29(3), 235-250.
- ITC (International Trade Centre). 2010. Spice Sub-Sector Strategy for Ethiopia. Addis Ababa, Ethiopia.

- Iwu, M.M. (1998). Empirical investigations of dietary plants used in Igbo ethno medicine Redgroo Publication. Co. New York.
- Iwu, M. M . (2014). Handbook of African medicinal plants. Francis & Taylor Group, Boca Raton, FL, pp. 279–333.
- Iyer, A. , Panchal, S. , Poudyal, H. , Brown, L . (2009). Potential health benefits of Indian spices in the symptoms of the metabolic syndrome: a review. *Indian Journal of Biochemistry and Biophysics* 46: 467–481.
- Kaefer, C. M. , Milner, J. A . (2011). Herbs and spices in cancer prevention and treatment. Chapter 17. In: Benzie, I. F. F. , Wachtel-Galor, S. (eds.) *Herbal Medicine: Biomolecular and Clinical Aspects*. CRS Press/Taylor and Francis, Boca Raton, FL
- Kinsella, J. E. (2015). The role of spices in health and nutrition. *Nutrition Journal*, 14(3), 1-7.
- Klin-Kabari, B. B. , Barimalaa, I. S. , Achenwu, S. C . (2011). Effect of three indigenous spices on the chemical stability of smoked dried catfish (*Clarias lazera*) during storage. *African Journal of Agriculture and Nutrition and Development* 11: 5–9.
- Kochhar, K. P . (2008). Dietary spices in health and diseases (II). *Indian Journal of Physiology and Pharmacology* 52: 327–354.
- Krishnaswamy, K . (2008). Traditional Indian spices and their health significance. *Asia Pacific Journal of Clinical Nutrition* 17 (Suppl) 1: 265–268.
- Linhart, Y. B. , Gauthier, P. , Keefover-Ring, K. , Thonpson, J. D . (2015). Variable phytotoxic effects of *Thymus vulgaris* (Lamiaceae) terpenes on associated species. *International Journal Plant Science* 176: 20–30.
- Lobo, V. , Patil, A. , Phatak, A. , Chandra, N . (2010). Free radicals, antioxidants and functional foods: impact on human health. *Pharmacognosy Reviews* 4: 118–126.
- Mann, A . (2011). Biopotency role of culinary spices and herbs and their chemical constituents in health and commonly used spices in Nigerian dishes and snacks. *African Journal of Food Science* 5: 111–124.
- Martin G (1995). *Ethnobotany: A methods Manual. A People and Plants Conservation Manual*. WWF International, UNESCO and Royal Botanic Gardens, Kew. Chapman and Hall, London.
- Masresha Yimer. 2010. Market profile on spices in Ethiopia. Addis Ababa, Ethiopia.
- Mathewos Agize. (2016). Spice and Medicinal Plants Production and Value Chain Analysis from South-West Ethiopia. *Journal of Pharmacy and Alternative Medicine*, 10: 2222 – 2230.
- Mnandhar, N.P. (1995): *Journal of Herbs, Spices and Medicinal plants*. 3:7 – 77.

- Mubeen, H., Naeem, I. Taskeen, A. and Saddiqe, Z. (2009): Investigations of heavy metals in commercial spices brands. *New York Science Journal* 2(5) : 155- 200.
- Newman, D. J. , Cragg, G. M . (2012). Natural products as sources of new drugs over the 30 years from 1981 to 2010. *Journal of Natural Products* 75: 311–335.
- Ngassoum, M. , Jirovetz, L. , Buchbauer, G . (2001). SPME/GC/MS analysis of headspace aroma compounds of the Cameroonian fruit *Tetrapleura tetraptera* (Thonn) Taub. *European Food Research and Technology* 213: 18–29.
- Nwaehujor, C. O. , Eban, L. K. , Ode, J. O. , Ejiofor, C. E. , Igile, G. O . (2014) Hepatotoxicity of methanol seed extract of *Aframomum melegueta* [Roscoe] K. Schum. (grains of paradise) in Sprague-Dawley rats. *American Journal of Biomedical Research* 2: 61–66.
- Nwafor, C. U., & Ogwueleka, R. A. (2020). Biodiversity Conservation and Deforestation Challenges in Nigeria: Implications for Sustainable Development. *International Journal of Environmental Science and Technology*, 17 (4): 2371 - 2386.
- Oakey, E. (2004). Home gardens: A cultural responsibility, Magazine on low External Inputs and Sustainable Agriculture. 20(i), LEISA, The Netherlands, pp: 23-25.
- Oboho, E.G. (2014b). Towards enhancing the sustainability of a valuable NTFP: *Pleukenetiaconophora* (walnut) (M. Arg.) in Benin Metropolis. Proceedings of the 3rd Annual Conference of Association of Women in Forestry and Environment (AWIFE) 13 – 18.
- Oboho, E. G. Egbuche, C. T. and Ogbolu, R. U. (2016). Forest crops of spice value in Benin-city: Their uses and marketing. *Annals of Biological Research*, 7 (5): 24 - 35
- Odugbemi, T . (2008). A Textbook of Medicinal Plants in Nigeria. Tolu Press Lagos. pp. 23–97.
- Ogunka- Nnoka, C.U. and Mepba, H.D. (2008): Proximate composition and antinutrient contents of some common spices in Nigeria. *Open Food Science Journal* 2: 62–67.
- Ogunleye, O. S. and Ogunleye, S. O. (2018). The Role of Forest Products in Rural Development: Implications for Poverty Alleviation in Nigeria. *Journal of Forest Research*, 29 (6): 1415 - 1421.
- Ojo, J. S., Adesina, S. K., & Olaniyan, T. C. (2022). Dynamics of spice markets in urban Nigeria: Challenges and prospects. *Nigerian Journal of Agricultural Economics*, 9(1), 64-78.
- Olife, I. C. Onwualu, A. P. Uchegbu, K. I. and Jolaoso, M. A. (2013). Status Assessment of spice resources in Nigeria. *Journal of Biology, Agriculture and Health Care*, 3 (9): 12 - 18

- Opara, E. I. , Chohan, M . (2014). Culinary herbs and spices: their bioactive properties, the contribution of polyphenols and the challenges in deducing their true health benefits. *International Journal of Molecular Sciences* 15: 19183–19202.
- Orwa, C. , Mutua, A. , Kindt, R , Jamnadass, R. , Anthony, S . (2009). Agroforestry Database: a tree reference and selection guide version. World Agroforestry Center, Kenya.
- Osayande, A., Edobor, W.W. and Kato, S. (2019). Effectiveness of Gully Erosion Control Measures in Edo State, Nigeria. *Open Access Library Journal*, 6: e5018. <https://doi.org/10.4236/oalib.1105018>
- Phillips, O. & A.H. Gentry. (1993). The useful plants of Tambopata, Peru: I. Statistical hypotheses tests with a new quantitative technique. *Economic Botany* 47:15-32.
- Phillips, O.L., A.H. Gentry, C. Reynel, P. Wilkin & C. Galvez-Durand. (1994). Quantitative ethnobotany and Amazonian conservation. *Conservation Biology* 8:225-248.
- Revathi P., T. Parimelazhagan and S. Manian (2013). Ethnomedicinal plants and novel formulations used by Hooralis tribe in Sathyamangalam forests, Western Ghats of Tamil Nadu, India. *J. Med. Plants Res.*, 7(28): 2083-2097.
- Sigh, S . (2007). From exotic spice to modern drug? *Cell* 130: 765–768.
- Singletary, K . (2016). Thyme: history, applications, and overview of potential health benefits. *Nutrition Today* 51: 40–49.
- Tapsell, L. C. et al. (2006). Health benefits of herbs and spices: the past, the present, the future. *The Medical Journal of Australia*, 185: S4–S24.
- Tumoro, G. and Maryo, M. (2016). Determination of informant consensus factor and fidelity level of ethnomedicinal plants used in Misha Woreda, Hadiya Zone, Southern Ethiopia. *International Journal of Biodiversity and Conservation*; Vol. 8(12), pp. 351-364.
- Uyom, E. A. , Ita, E. E. , Nwofia, G. E . (2013) Evaluation of the chemical composition of *Tetrapleura tetraptera* (Schum and Thonn.) Taub. accessions from River State Nigeria. *International Journal of Medicinal and Aromatic Plant* 3: 386–394.

## APPENDIX

### Appendix 1: RESEARCH QUESTIONNAIRE

DEPARTMENT OF FOREST RESOURCES AND WILDLIFE MANAGEMENT,  
FACULTY OF AGRICULTURE, UNIVERSITY OF BENIN, BENIN CITY, NIGERIA

#### RESEARCH QUESTIONNAIRE

On

#### INVESTIGATION OF PLANTS OF SPICE VALUE IN SELECTED MARKETS WITHIN BENIN CITY, EDO STATE, NIGERIA

Please note that this research questionnaire is meant for academic study, therefore all information provided will be regarded as confidential and will be used for academic purposes only. Please tick/fill appropriately and thanks for your cooperation.

#### Respondent details

1. Name of respondent: .....
2. Marital status: a) single ( ) (b) married ( )
3. Sex: (a) male ( ) (b) female ( )
4. Occupation: (a) Spice trader ( ) (b) Spice farmer ( ) (c) Both
5. Age: (a) less than 20 years ( ) (b) 20-40 years ( ) (c) 41 – 60 years (d) above 60 years ( )
6. Education qualification: (a) primary school certificate ( ) (b) secondary school certificate ( ) (c) tertiary education ( ) (d) No formal education
7. Religion: .....
8. The name of the market.....
9. Size of the market (a) Big (b) Small (c) Average
10. Business experience: a) below 5yrs ( ) (b) 5-10 yrs. ( ) (c) above 10yrs ( )

#### Plant details

1. Name plant spice/species that are commonly sold in markets: .....
2. Botanical name and family: .....
3. Major plant part used/ sold :(a) roots ( ) (b)bark ( ) (c)leaf ( ) (d)fruit ( ) (e) seed ( ) (f) all parts ( )

4. Classify the plant spice availability (a) abundance ( ) (b) scarce ( ) (c) lack of access ( ) (d) others ( )
5. Form sold (a) Dried ( ) (b) Fresh ( ) (c) powder ( )
6. Is this spice plant used in combination with other spice plant? (a) Use singly ( ) (b) combined with other plant ( ) optional ( )
7. Which spice species is it combined with .....
8. Do you at times use the product you sell to treat yourself when you're sick? (a) Yes ( ) (b) No ( )
9. Do you use some of the spices to cook? (a) Yes ( ) (b) No ( )
10. Is there any side effect associated with the use of this spice species? (a) Yes ( ) (b) No ( ) (c) sometimes ( )

**Major spice part traded in the market**

**Keys for Plant Parts:** L = Leaves; B = Barks; R = Roots; F = Fruits; S = Seeds; AP= all parts

S/N	Botanical name	Spice local name	Part(s) used	Form Used (dried, Fresh or powder)	Use(s) of Plant spice
1		Ajo			
2		Atako,			
3		Beletete			
4		Ebe-wiewa			
5		Ehien-edo			
6		Abeamwonkhoe			
7		Eyinyan			
8		Igbafilo			
9		Ikposa			
10		Omilo			
11		Oriema			
12		Osuwanden			
13		Oziza			
14		Unien			
15		Pepper fruit (Ako)			
16		Edun			
17		Osun			
18		Ginger			
19		Garlic			
20		Bagaruwa			
21		Cinnamon			

11. Source of trading materials (a) farm ( ) (b) forest ( ) (c) Home garden ( )
12. a) Are the plants annual ( ) or perennial ( )
  - b) Are they seasonal; when are they harvested (a) dry season ( ) (b) rainy season ( ) (c) all seasons ( )
13. How do you obtain the products you sell? (a) personal ( ) (b) supplied ( ) (c) purchase from rural market
14. What measures will you like to take in enhancing the supply of the products you sell? (a) planting in home garden ( ) (b) making farm of the items ( ) (c) assist the suppliers with funds to enhance cultivation ( ) (d) all of the above
15. Do you think you can continue to get spices if the forest is destroyed? (a) Yes ( ) (b)No( )
16. How does the sale of spice species contribute to your livelihood and wellbeing? (a) very strong ( ) (b) Strong ( ) (c) not strong ( )
17. What is your average annual income (₦).....
18. How did you know about spice species (a) parents/relatives ( ) (b) personal discovery ( ) (c) external sources ( ) (d) apprentices tutelage
19. What is the current cost of spice species (a) low ( ) (b) Average ( ) (c) high ( )
20. What are the changes in prices of these spice species for the past 3 years?

S/N	Botanical name	Spice local name	2023	2024	2025
1		Ajo			
2		Atako,			
3		Beletete			
4		Ebewiewa			
5		Ehiendo			
6		Abeamwonkhoe			
7		Eyinyan			
8		Igbafilo			
9		Ikposa			
10		Omilo			
11		Oriema			
12		Osuwanden			
13		Oziza			
14		Unien			
15		Pepper fruit (Ako)			
16		Edun			
17		Osun			
18		Ginger			
19		Garlic			

20		Bagaruwa			
21		Cinnamon			

21. Do you experience difficulty obtaining plant spice materials (a) Yes ( ) (b) No ( )

22. What are the difficulties faced in selling spice species? (tick one or more)

High cost/ price change	
Distance/ Transportation	
Climate change	
Competition with other vendors	
Ensuring high quality species	-
Seasonality/ Scarcity	
Over harvesting/ Exploitation	
Mis-identification of spice species	
High demand	
Preservation	
Low patronage	
Deforestation	
Farming	

### Appendix 2: ANOVA for Price of Spice plants

Source of variation	d.f.	s.s.	m.s.	v.r.	F pr.
Spices	15	1982500.	132167.	9.82	<.001
Years	2	3651910.	1825955.	135.71	<.001
Spices.Years	30	1225313.	40844.	3.04	<.001
Residual	96	1291667.	13455.		
Total	143	8151389.			

**Appendix 3: Average Price (₦) of some Spice plant sold for the past 3 Years**

S/N	Botanical name	Local/common name	YEARS		
			2023	2024	2025
1	<i>Tetrapleura tetraptera</i> Schumach.&Thonn	Ajo	150.0	400.0	1083.3
2	<i>Piper nigrum</i> (L.)	Black pepper	150.0	350.0	700.0
3	<i>Cinnamomum verum</i> J.Presl.	Cinnamon	150.0	300.0	700.0
4	<i>Ocimum basilicum</i> L.	Ebe-wiewa	250.0	450.0	800.0
5	<i>Heinsia crinita</i> (Afzel) G.Taylor.	Beletete	150.0	300.0	450.0
6	<i>Aframomum melegueta</i> K. Schum.	Ehien-edo	350.0	650.0	766.7
7	<i>Hymenostegia afzelii</i> (Oliv.) Harms.	Eyinyan	250.0	350.0	450.0
8	<i>Allium sativum</i> L.	Garlic	250.0	300.0	750.0
9	<i>Parinari excelsa</i> (Oliv.) Prance	Igbafilo	150.0	300.0	633.3
10	<i>Mondora myristica</i> (Gaertn.)Dunal	Ikposa	100.0	250.0	283.3
11	<i>Aframomum danielli</i> (Hook f.) K. Schum	Oriema	150.0	250.0	350.0
12	<i>Corandrium sativum</i> L.	Omilo	150.0	200.0	350.0
13	<i>Rhaphiostylis beninensis</i> (Hook. Jex Planck) ex Benth	Osuwanden	250.0	400.0	750.0
14	<i>Piper guineense</i> Schumach. & Thonn	Oziza	150.0	250.0	400.0
15	<i>Ocimum gratissimum</i> L.	Scent leaf	150.0	250.0	350.0
16	<i>Xylophia aethiopica</i> (Durand) A.Rich.	Unien	150.0	200.0	300.0