



MADDA WALABU UNIVERSITY
COLLEGE OF NATURAL AND COMPUTATIONAL SCIENCES
DEPARTMENT OF BIOLOGY

**ETHNOBOTANICAL STUDY OF WILD AND SEMI-WILD EDIBLE PLANTS IN
KOFALE SUB-DISTRICT OF WEST ARSI ZONE, OROMIA REGIONAL STATE,
ETHIOPIA**

BY: TEWODROS HAILU TESEMA

FEBRUARY, 2025
ROBE-BALE, ETHIOPIA

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**A THESIS SUBMITTED TO THE DEPARTMENT OF BIOLOGY, IN PARTIAL
FULFILLMENT OF THE REQUIREMENTS FOR THE DEGREE OF MASTER OF
SCIENCE IN BIOLOGY (BOTANICAL SCIENCES)**

**BY: TEWODROS HAILU TESEMA
ADVISOR: MOA MEGERSA GUTA (PhD)**

**FEBRUARY, 2025
ROBE-BALE, ETHIOPIA**

DEDICATION

I dedicated this thesis to my beloved wife Amarech Mamo for her valuable contribution in the success of my life.

DECLARATION

First, I declare that this thesis entitled “Ethnobotanical study of wild and semi-wild edible plants in Kofale sub-district of west Arsi Zone, Oromia Regional State, Ethiopia” is my own and all sources used for this thesis have been duly acknowledged. This thesis has been summated in practical fulfillment of the requirement for M.Sc. degree at the MaddaWalabu University and is deposited at the University library to be made available to borrowers under rules of the library. I solemnly declare that this thesis is not submitted to any other institution anywhere for the award of any academic degree, diploma, or certificate.

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LIST OF ABBREVIATIONS AND ACRONYMS

EIB	Ethiopian Institute of Biodiversity
ESS	Ethiopian Statistical Service
IPNI	International Plant Names Index
IUCN	International Union for Conservation of Nature
JSC	Jaccard similarity coefficient
KDANRO	Kofale District Agricultural and Natural Resource Office
POWO	Plants of the World Online
WEPs	Wild Edible Plants
WHO	World Health Organization

ABSTRACT

Wild edible plants are neither cultivated nor domesticated but are accessible from various natural ecosystems and exploited for food. The purpose of this study was to document wild and semi wild edible plants in Kofale Sub-Districts, West Arsi Zone, Oromia Regional State. Both quantitative and qualitative research methods were used. More specifically, cross-sectional study design was used. The purposive sampling techniques were used to select key informants, and simple random sampling techniques were used to select the general informants. Six kebeles were selected purposively from 43 kebeles in the district based on accessibility, proximity and availability of vegetation. A total of 72 (51 males and 21 females) were randomly selected through simple random sampling technique. Ethnobotanical data was collected using a semi-structured interview, field observation, focus group discussions and market survey. Descriptive statistics, informant consensus, preference ranking, direct matrix ranking, fidelity level index and jaccard's coefficient of similarity were used for data analysis. A total 44 Wild and semi-wild edible plants species were documented in the study area. These wild edible plants were belonging to 34 general and 27 families. Moraceae was the most popular family which contributed five (11.3%) species followed by Fabaceae which contributed 4 (9.09%) species. Of these plant species, shrubs account for 18 (40.9%), followed by herbs 15 (34.1%). Regarding the edible parts, fruits account for 33 (75%) followed by leaves 4 (9.09%). Cordia africana and Opuntia ficus indica are the most preferred wild edible plants in the study area. Cordia africana, Syzygium guineense and Carissa spinarum are species with multiple uses. Agricultural land expansion, fire wood collection and charcoal production and other factors were the top prioritized threats affecting the abundance and diversity of wild edible plants. Hence, the finding recommends that the community practice in situ and ex-situ conservation, public awareness raising, which requires participation of the government's on sustainable use of these resources to address food insecurity and forest management practices approach would help to protect wild edible plant in study area.

Keywords: *Ethnobotany, Indigenous knowledge, Kofale District, Wild and semi wild edible plants*

1. INTRODUCTION

1.1. Background

Wild edible plants (WEPs) refer to edible species that are not cultivated or domesticated but are collected from the natural environment and used as food sources (Yangdon *et al.* 2022). Humans have an instinct to survive by relying on nature, including plant resources. Wild edible plants are plants that grow naturally and can be consumed by humans or animals. Wild edible plants have been used in various conditions, including as emergency food during disasters or unfortunate events such as during the European famine (Catarino *et al.*, 2024).

In several parts of the world, people frequently use of WEPs species as their main source of nutrition, especially during times of famine and seasonal food scarcity (Asfaw *et al.* 2023). WEPs play a significant role in the long history of human adaptation to natural habitats, social interactions with nature and environmental conditions and many people around the world depend on them for food (Tao, 2020). In the modern era, there is a growing interest in wild edible plants with the increasing paradigm of going back to nature, reinforced by the knowledge that categorizes them as new functional food (Catarino *et al.*, 2024). This might be due to the rising concern of global hunger attributable to the increasing human population and urban development (Ghosh *et al.* 2024).

Moreover, rural communities in developing countries depend on wild edible plants as additional nutrient-rich food sources during food shortages (Berihun and Molla 2017). These wild plants provide vitamins, micronutrients and in maintaining food and nutrition security. Moreover, the utilization of WEPs enhances socio-ecological resilience for the sustainable development of communities (Pereira *et al.* 2020). Therefore, the integration of indigenous wild edible plants as sources of micro and macronutrients could play an immense role in addressing the problems of prevailing malnutrition and food insecurity and advancing the sustainable development goal of ending hunger, as outlined by the United Nations (Datta and Behera, 2024).

In Africa different ethnobotanical studies have revealed that wild edible plants are an importance component of many African, especially during famine or food shortages (Mwajombe *et al.*, 2022; Oduor *et al.*, 2023). A study conducted in Kenya revealed that

73 WEPs are used by local communities in Turkana County (Oduor *et al.*, 2023). It was reported that WEPs have the potential to bridge food and nutritional deficits in food insecure households in Turkana County, Kenya (Oduor *et al.*, 2023). A study by Mwajombe *et al.* (2022) reported that WEPs are an important source of nutrients and income for poor households and hence reduce vulnerability to food insecurity in rural areas of Tanzania Mwajombe *et al.* (2022). However, due to various environmental factors, the availability of WEPs and the associated indigenous knowledge are declining at the fastest rate. Moreover, these plant species play a role in generating household income (Duguma, 2020). The loss of these WEPs also could risk the food security (Ghanimi *et al.*, 2022). Furthermore, indigenous knowledge is fast vanishing; thus, future WEPs nutritional analyses and use recommendations should document and disseminate this knowledge (Fassil *et al.*, 2024).

Some WEPs contain more nutrients such as vitamins, mineral and carbohydrates, than cultivated plants, suggesting they can serve as an alternative nutritional source, especially during food shortages (Pinela *et al.* 2017; Mishra *et al.* 2021). However, not all wild plants are safe to eat because they also can be harmful. Therefore, the utilization of wild plants as food sources should be done with awareness and adequate botanical and ecological knowledge. Malnutrition remains a persistent public health issue in sub-Saharan Africa, impacting health, mental well-being, productivity, and economic progress (Cordeiro, 2013; Peduruhewa *et al.*, 2021). Thirty-eight (38%) of Ethiopian children less than five years of age suffer from chronic malnutrition, and 22% of women of reproductive age are undernourished (Biru and Mena 2020). They provide valuable nutritional supplements (nutraceuticals), including vitamins, polyphenols, antioxidants, and flavonoids, trace elements and have very low lipid levels (Disciglio *et al.*, 2017; Yiblet, 2024). Over time, the consumption of WEPs has evolved into a cultural tradition (Haokip and Panmei 2022). Nonetheless, wild edible plant consumption has significantly decreased in the modern era due to globalization, land conversion of natural vegetation into other land uses (e.g., settlement and industry), and socio-economic transition and changes in culture and lifestyle. These factors contribute to modernization, leading to the reduction in natural land, which serves as WEPs habitats and the decrease in public knowledge regarding their uses (Al Yamini *et al.* 2023).

Nowadays, people have shifted from consuming wild edible plants obtained from nature to buying raw materials in the market, resulting in the erosion of the culture and knowledge of the villagers regarding WEPs (Pereira et al. 2020). Many people in developing countries do not have enough food to meet their daily needs. As a result, they are mainly dependent on wild edible plants (Badimo et al., 2015; Mukhtar, 2016). This implies that wild edible plants play important roles in food security for rural communities the entire world (Ju *et al.*, 2013). Hence, the incorporation of wild edible plants can contribute to the fulfillment of the United Nations' sustainable development objective of eradicating hunger (Singh et al., 2019). This is because hunger malnutrition impedes sustainable development by diminishing productivity, worsening vulnerability to illnesses, and limiting possibilities for enhancing livelihoods.

Ethiopia, with its diverse agro-ecologies, hosts a remarkable biodiversity, encompassing 6027 plant taxa (Kelbessa and Demissew, 2014). Among these, 413 are wild edible plants (Lulekal et al., 2011). However, Ethiopia's biodiversity faces numerous threats, including farmland expansion, climate change, the introduction of exotic species, and over-exploitation, all of which contribute to the country's food insecurity (Gebretsadik, 2016; Sabates-Wheeler et al., 2012). As a result, many rural communities depend on edible wild plants found in their local environments (Feyssa et al., 2011; Tebkew et al., 2014). The types of edible plants and the parts consumed vary among Ethiopia's many ethnic groups, each with distinct cultures (Teklehaymanot and Giday, 2010). Therefore, understanding the variation in indigenous knowledge of WEPs and plant taxa is essential for implementing appropriate conservation measures. This knowledge also aids in identifying valuable edible wild plants to be integrated with crops. While various studies have documented wild edible plants in different regions of Ethiopia, such as 44 species in Metema District, Amhara Regional State (Masresha et al., 2023), 59 species in Raya-Azebo District, Tigray Region (Giday and Teklehaymanot, 2023), 41 species in Mieso District, East Hararghe Zone (Tahir et al., 2023), 50 species in Midakegn District, West Shewa Zone (Guzo et al., 2023), 54 species in Dibatie District, Metekel Zone, Benishangul Gumuz Regional State (Anbessa et al., 2024), and 36 species in Arsi Robe District, East Arsi Zone (Biri et al., 2024), no ethnobotanical studies have yet been conducted in Kofale District. Therefore, this study aims to document the wild edible

plants used by local communities in Kofale District, West Arsi Zone, Oromia National Regional State, Ethiopia.

1.2. Statement of the problem

Wild edible plants (WEPs) are naturally occurring plants that are not cultivated by humans but serve as a dietary food source for people (Saravanan et al., 2020). Throughout history, WEPs have been a crucial part of the human diet (Walish, 2022). However, with the advancement of modern agriculture, urbanization, and globalization, there has been an increasing disconnect between populations and their natural environments (Turner, 2018). As a result, the transfer of knowledge from older generations to younger ones is not always guaranteed (Hopkins et al., 2015), leading to a decline in the use and understanding of wild plants (Singh et al., 2020). According to Yadav et al. (2023), out of 300,000 plant species, only about 10,000 have been used for human food since the beginning of agriculture, and today, this number has dwindled to just a few dozen. This loss of agricultural and food biodiversity poses a significant risk to food security (Norris, 2021).

Several studies have been conducted across different regions of Ethiopia to document the use of wild edible plants. For example, Ashagre et al. (2016) found in the Southern Region of Ethiopia that WEPs are not only nutritionally valuable but also serve as a significant source of income through local markets. In various lowland areas of Ethiopia, Dejene et al. (2020) observed a wide variety of WEPs that are easily accessible and provide nutritional, medicinal, and commercial benefits. However, there is still a lack of site-specific identification, local community preferences for WEPs, and an investigation into the major threats these plants face, which are critical for their future conservation and sustainable use.

These issues are particularly evident in the West Arsi Zone of Oromia Regional State, Ethiopia, including Kofale District, which is experiencing a loss of wild edible plant species due to fuel and timber production, firewood collection, overgrazing, charcoal production, as well as natural factors like fires and infrastructure expansion. Therefore, this study aims to address these issues and fill the existing knowledge gap. The primary objective of this research is to conduct an ethnobotanical study of wild and semi-wild edible plants used by local communities in Kofale Sub-Districts, West Arsi Zone, and

Oromia Regional State, Ethiopia and to contribute to the conservation.

1.3. Objectives of the Study

1.3.1. General objective

The general objective of the study was to document wild and semi-wild edible plants used by local communities in Kofale Sub-Districts, West Arsi Zone, and Oromia Regional State, Ethiopia.

1.3.2. Specific objectives

The specific objectives of this study were:

1. To identify parts of the plants used for consumption in the Kofale sub-district.
2. To assess the most preferred and widely used wild edible plants in the Kofale sub-district.
3. To assess the major conservation that currently exists to the WSWEPs of the study area.
4. To assess the major threats to the WSWEPs of the study area

1.4. Research Questions

This study was specifically answering the following research questions:

1. What is the wild edible plant parts used in the Kofale sub-district?
2. What are the most popular wild edible plants used as food in Kofale sub-district?
3. What is the major conservation status of wild edible plants of Kofale sub-district?
4. What are the major threats of wild edible plants of Kofale sub-district?

1.5. Significance of the Study

To the best of my knowledge, no prior studies have been conducted on wild and semi-wild edible plants in the Kofale district, located in the West Arsi Zone of the Oromia National Regional State, Ethiopia. This study offers valuable insights into the role and importance of wild edible plants in providing income for the local communities of the Kofale district. It also contributes to the development of strategies to mitigate existing threats to these plants. Furthermore, it serves as a foundation for the conservation and sustainable use of wild edible plants. The findings of this research are the first of their kind in the region, offering the local community essential knowledge about the use of wild edible plants. The study also raises awareness about the challenges faced by these

plants and the need to address the threats to certain species. Additionally, the results may serve as a reference for future research, particularly those interested in conducting nutritional analyses of wild edible plants.

2. LITERATURE REVIEW

2.1. Wild Edible Plants

Wild edible plants (WEPs) can be defined as native species that grow and reproduce naturally in their natural habitat without being cultivated (Borelli et al. 2020). For generations, the majority of rural communities have used wild edible plants for food, medicine, and other purposes (Aryal et al., 2009). According to the Food and Agriculture Organization (FAO), WEPs are defined as non-cultivated and non-domesticated plants (Shumsky et al., 2014). Although there are plenty of different plant species in our world, only a few of them have been used as food by humans (Blanco-Salas et al., 2019). This indicates that numerous of the plant species in our world have not been effectively domesticated and studied.

Wild edible plants (WEPs) are among them. The term wild edible plants refer to plants that are not domesticated and that have at least one edible component, such as a leaf, root, or fruit (Shaheen et al., 2017). Wild edible plants are frequently consumed because of associations with food scarcity and poverty, climatic extreme events, or political instability times (Carvalho and Barata, 2016). Many people in developing countries do not have enough food to meet their daily needs. As a result, they are mainly dependent on wild edible plants (Badimo et al., 2015; Mukhtar, 2016). This implies that wild edible plants play important roles in food security for rural communities the entire world (Ju et al., 2013). Hence, the incorporation of wild edible plants can contribute to the fulfillment of the United Nations' sustainable development objective of eradicating hunger (Singh et al., 2020). This is because hunger and malnutrition impede sustainable development by diminishing productivity, worsening vulnerability to illnesses, and limiting possibilities for enhancing livelihoods.

Moreover, several research findings suggest that wild edible plants have superior nutritional compositions necessary for proper body growth compared to agricultural crop foods (Alam et al., 2020; Khan et al., 2016; Shaheen et al., 2017). Equally, these days, people are increasingly aware of the medicinal benefits of wild edible plants in addition to their nutritional value (Grace and Kayode, 2018; Mokganya and Tshisikhawe, 2019). However, due to various environmental factors, the availability of wild edible plants and the associated indigenous knowledge are declining at the fastest rate.

In various regions of our world, wild edible plant species are commonly consumed and utilized as a primary source of sustenance, particularly during periods of seasonal food scarcity and in times of famine (Balemie & Kebebew, 2006; Powell *et al.*, 2015). For instance, during the time of great famine in Ethiopia most people were survived through the use of wild edible plants but at this moment these plants are under estimated (Guinand & Lemessa, 2000). The utilization of wild edible plants not only contributes to the nutritional diversity of individuals residing in rural areas (Dejene *et al.*, 2020; Mengistu & Hager, 2008), but also serve as a strategy to enhance the nutritional value of diets (Ickowitz *et al.*, 2016). Moreover, these plant species play a role in generating household income (Duguma, 2020).

Ethiopia has 6027 plant taxa due to its diverse agro-ecologies that have favored high biodiversity (Kelbessa and Demissew, 2014). Out of these, 413 of them were wild edible plants (Lulekal et al., 2011). However, the country's biodiversity is currently under threat from a variety of sources. Farmland expansion, climate change, exotic species introduction, and overexploitation are among the most serious threats (Gebretsadik, 2016). This indicates that many plant taxa face greater threats before they are investigated and their economic values are determined. Several studies have been conducted in various regions of Ethiopia to document the presence of wild edible plants. Ashagre et al. (2016) conducted a study in the Southern Region of Ethiopia and found that these plants not only have nutritional value but also serve as a significant source of income through local market sales. In various lowland areas of Ethiopia, Dejene et al. (2020) observed a wide variety of wild edible plant species that are easily accessible provide numerous nutritional, medicinal, and commercial benefits.

Humans have gathered WEPs since ancient times, and they have become part of the human diet and traditional food systems. WEPs are one of the main non-timber forest products and possess up to 96% of the value of forests (Mallika and Charlie 2019). Wild edible plants are non-cultivated edible plants collected from wild habitats (Termote et al., 2011). WEPs still play an important role when food crops are scarce, ensuring food sovereignty and food security, and they potentially contribute to wellbeing in vulnerable households (Borelliet al. 2020). Millions of people in many developing countries do not have enough food to meet their daily requirements and further more people are deficient

in one or more micronutrients (Jacques, 2004). Edible wild plants have supplementary, seasonal and emergency roles in the communities.

Wild edible plants (WEPs) are native species that grow and reproduce naturally in their natural environment, without human cultivation (Borelli et al., 2020). For generations, rural communities have relied on wild edible plants for food, medicine, and other purposes (Aryal et al., 2009). The Food and Agriculture Organization (FAO) defines WEPs as non-cultivated and non-domesticated plants (Shumsky et al., 2014). While numerous plant species exist worldwide, only a limited number have been used as food by humans (Blanco-Salas et al., 2019). This suggests that many plant species remain underutilized and have not been extensively studied or domesticated.

WEPs refer to plants that have at least one edible component (such as leaves, roots, or fruits) and are not domesticated (Shaheen et al., 2017). They are often consumed in situations of food scarcity, poverty, climate extremes, or political instability (Carvalho & Barata, 2016). Many people in developing countries face food insecurity and rely on wild edible plants to meet their daily nutritional needs (Badimo et al., 2015; Mukhtar, 2016). As a result, these plants play a crucial role in ensuring food security for rural communities worldwide (Ju et al., 2013). Integrating wild edible plants into diets could contribute to the United Nations' sustainable development goal of eradicating hunger (Singh et al., 2020), as hunger and malnutrition hinder sustainable development by reducing productivity, increasing vulnerability to diseases, and limiting opportunities to improve livelihoods.

Moreover, several studies suggest that WEPs are nutritionally superior to cultivated crops, providing essential nutrients for proper body growth (Alam et al., 2020; Khan et al., 2016; Shaheen et al., 2017). In addition to their nutritional value, wild edible plants are increasingly recognized for their medicinal benefits (Grace & Kayode, 2018; Mokganya & Tshisikhawe, 2019). However, various environmental factors have led to a rapid decline in the availability of WEPs and the indigenous knowledge associated with them. Across the globe, these plants are commonly utilized as a primary food source, particularly during periods of food scarcity and famine (Balemie & Kebebew, 2006; Powell et al., 2015). For instance, during past famines in Ethiopia, wild edible plants played a vital role in survival, but today they are often underestimated (Guinand &

Lemessa, 2000).

The use of WEPs not only enhances the nutritional diversity of diets in rural communities (Dejene et al., 2020; Mengistu & Hager, 2008), but also serves as a strategy to improve overall nutrition (Ickowitz et al., 2016). Additionally, these plants generate household income (Duguma, 2020). Ethiopia, with its diverse agro-ecologies, is home to 6027 plant species, of which 413 are wild edible plants (Kelbessa & Demissew, 2014; Lulekal et al., 2011). However, Ethiopia's biodiversity is under threat from farmland expansion, climate change, the introduction of exotic species, and overexploitation (Gebretsadik, 2016). This situation means many plant species are at risk before their economic potential is fully recognized. Several studies have documented the role of wild edible plants in Ethiopia. For example, Ashagre et al. (2016) found that these plants not only provide nutritional value but also serve as an important income source through local markets that use them for food; and some are also used as a source of income (EBI, (2015)). According to FAO (2010), more than 35% of Ethiopian people are food insecure. The country's ever increasing population along with recurrent drought, war and poor agricultural practices with low productivity, have pulled the country into a vicious circle of food insecurity. In addition, over dependence on a limited number of food sources and poor efforts to diversify dietary sources aggravate the country's food insecurity problem. These plant resources are collected outside of agricultural areas mainly from forests for human consumption (Addis et al. 2013). Wild edible foods may be consumed as raw or prepared into vegetables (Tiwari et al. 2010), and they are the crucial source of wild foods for the rural communities in different parts of the globe (Addis et al. 2013). Different parts (fruits, leaves, stem, root, tuber, flower and others) of wild edible plant species are used as edible worldwide. Wild edible plants (WEP) provide staple food for indigenous people, serve as complementary food for non-indigenous people and offer an alternative source of cash income for poor communities (Ju ,et al,2013).

In some areas it may grow wild, while in other areas it can be protected and managed by farmers. It also refers to plants that are not cultivated and that can be gathered in the field. If a plant is considered as a wild plant depends on the location Wild plants play an important role in rural communities, as the natives mostly depend on plants for food,

traditional medicine and other livelihood requirements. The use of edible wild plants forms a part of the cultural traditions of rural and suburban societies throughout the world. In recent years, local knowledge has been increasingly studied using various ethnobotany tools to identify plants with high nutritional, medical and commercial potentials which are likely to contribute in better living of rural population. Wild edible plants: Are wild plants with one or more (Ermias, et al., 2011).Parts that can be used for food if gathered at the appropriate stage of growth, and properly prepared (Ermias, et al., 2011).Indigenous people are endowed with knowledge of seasonal availability of WEPs and implications to climate change adaptations. The available information on the seasonal availability and their contribution to climate change adaptation was poorly documented in Ethiopia.

2.2. Wild Edible Plants in Ethiopia

Wild edible plants (WEPs) are a vital source of food for indigenous populations and serve as supplementary nutrition for non-indigenous groups. While rural communities have relied on wild plants for generations, the full extent of edible wild plant consumption and the traditional knowledge surrounding them remains underexplored,with limited ethnobotanical documentation. This study is one of the first attempts to systematically document wild edible plants in Ethiopia. These plants serve as crucial sources of nutrition, especially in times of famine or seasonal food shortages (Asfaw *et al.*, 2023).

Ethiopia's diverse geography, combined with its rich array of native plant species, supports a wide variety of WEPs.The country is home to approximately 6,000 endemic plant species (Hedberg et al., 2009). WEPs thrive in the nation's forests, woodlands, grasslands, riverine areas, and farmlands, contributing significantly to local diets (Asfaw, 2009). Moreover, Ethiopia possesses a wealth of indigenous knowledge tied to its abundant biodiversity (Tizita, 2016). Many Ethiopian communities depend on wild edible plants as a regular part of their diet, especially in areas experiencing food insecurity (Teklehaymanot and Giday, 2010). Approximately 8% of Ethiopia's vascular plant species are used as food, with around 75% of these being wild, semi-wild, or naturalized species across various agroecological zones (Asfaw and Adesse, 2001).

Recent studies, such as one by Lulekal et al. (2011), have documented 413 WEP species across 224 genera and 77 families in Ethiopia. However, this number may increase as further ethnobotanical research is conducted, particularly in less-studied regions. The plant families with the largest number of WEP species include Fabaceae (35 species), Tiliaceae (20 species), and Capparidaceae (19 species). In terms of plant growth forms, shrubs account for the largest proportion (31%), followed by trees (30%), herbs (29%), and climbers (9%). It is important to note that previous ethnobotanical studies have covered only about 5% of the country's total area, highlighting the potential for discovering more wild edible plants (Lulekal et al., 2011).

Wild edible plants play an essential role in the livelihoods of rural populations across Ethiopia. In southern Ethiopia, for instance, the Konso people, who maintain strong indigenous traditions, consume WEPs both as a supplement to staple foods (approximately 70%) and as a critical resource during times of food scarcity, such as droughts and famines (Tebkew et al., 2018). The consumption of WEPs is particularly important during critical periods, such as the early rainy season when previous harvests are depleted and when climatic factors exacerbate food insecurity (Faye et al., 2010). The use of wild edible plants varies across regions, with some communities compensating for reduced or damaged crop yields by gathering more wild food plants (Addis et al., 2013). During times of relative abundance, WEPs are often consumed as snacks, especially in the form of ripe fruits. Many wild edible plants are rich in nutrients, including carbohydrates, proteins, vitamins, and minerals, which can help maintain health and prevent diseases (Hunde et al., 2012; Addis et al., 2013).

2.2.1. Wild edible Plants and their Nutrition

Wild edible plants are plants that occur on a wild or are grown in local scale, and are categorized as underutilized whose economic potential have been poorly addressed to only traditional and local use (Misra, 2016). In addition to cultivation crops, Ethiopia flora contains many wild plants that produce quantities of food so, natural habitats, farm lands and home gardens are sources of edible plants. In addition to cultivated plants, peoples in developing countries use WEPs as food during the period of food deficit (Jadhav, *et al.*, 2011, Dogan and Ugulu, 2013). Especially in the time of starvation WEPs still play important roles in human nutrition (Khanal, 2006). FAO (2010) estimated

that there are about 1.02 billion people that are undernourished. According to Ermias, *et al.* (2011) different parts of food plants like leaves, stems, fruits, flowers, tubers, barks, seeds, roots and others are still consumed for their dietary value in many communities around the globe. Many WEPs are nutritionally rich and can supplement nutritional requirement. Generally, the information available from the nutritional analysis of WEPs shows their potential contribution to dietetic diversity and food security.

2.2.2. Potential contribution of WEPs to food security

Seasonal food insecurity or shortage of enough food is the main problem in developing countries in Ethiopia. Most of the people in rural areas face several challenges like environmental degradation, drought, deforestation and climate change. These result in a serious food insecurity among households (Sabatsec *et al.*, 2012). FAO (2010) estimates that there are about 852 million people worldwide who are undernourished. Out of this 9 million are in industrialized countries, 28 million are in countries in transition and 815 million are from developing countries. The number of hungry people with shortage of food is growing at a rate of 4 million a year and in developing countries there are about 820 million people that suffer with shortage of food (FAO, 2010). More than 35% of Ethiopian people are food insecure (FAO, 2010).

In addition, our global food system is in trouble. By 2050; estimates suggest that the global population will grow to 10 billion and our current agricultural infrastructure cannot guarantee a healthy and nutritionally balanced diet for that people. Therefore, to improve food and nutrition security, focusing on different dimensions of food sources like wild edible food is very crucial. Every living organism in the world impossible to survive without plants so their contribution for food security has fundamental value so, different researchers stated different values about plant diversity particularly WEPs. As suggested by (Cotton, 1996) almost all living organisms ranging from bacteria to large mammals gain protection and nourishment from plants. Humans derive food, medicines and a number of ecosystem services such as in purification, origin and recharge of water bodies, nitrogen fixation, cycling of nutrients as well as many more range of other products from plant biodiversity (Khanal, 2006). When compared to domesticated plant food sources, wild plant foods tend to be overlooked. As cited by (Ermias *et al.*, 2011), over 50% of the world's daily requirement of proteins and calories

are obtained from only three crops: Wheat, Maize and Rice. The dependence on a few domesticated species limits food diversity & leads to over dependence on limited resources. These indicated that there are many WEPs which are important but unknown by ethno botanists so, farther study indifferent districts have been ongoing processes. Wild sources of food are important for the poor and landless, and are especially important during times of famine or conflict when normal food supply mechanisms are disrupted. According to (Tardio *et al.*, 2006) even under normal conditions, wild plants have played an important role in complementing staple foods to provide balanced diets.

2.2.3. Sources of income

Market assessment of wild edible plant species showed that most of the edible plants are not sold only for food purposes but also for other purposes such as for timber, agricultural tools, construction, and fuel wood purpose. The other economically important and marketable species is *Cordia africana*. It is the most preferred timber species with higher value and price at local markets. In general income derived from the sale of wild plant species is of particular importance to the poor household to supplement their food product items and needs. Most of the identified wild edible plants were marketed in the other part of Ethiopia (Tinsae *et al.* 2013). A few numbers of wild foods sold in the market were also reported by other studies made in Ethiopia (Asfaw 2008).

2.3. Threats and conservation of Wild Edible Plants

2.3.1. Threats of Wild Edible Plants

Based on research findings, indigenous people living in forests best know, use and protect biodiversity. However, the survival and existence of indigenous people and their long-term accumulated knowledge faces challenges as a result of modernization, genetic erosion on plant and animal resources, low recognition to their knowledge, varied culture and loss of biodiversity (Martin, 1995: and Cotton, 1996). Environmental crises like global warming, loss of biodiversity and deforestation are becoming the major tribulations of human beings. In Ethiopia, WEPs are facing threats in natural habitats from various human activities such as fuel wood collection, harvesting for timber and walling or poles, (Kebu and Fassil, 2006). These practices adversely affect

WEPs in the country and lead to reducing of economically crucial food plants (Assefa and Tesfaye, 2011). When the plants that have been serving as the raw material for the preparation of the different remedies are being destroyed, the traditional practices associated with them would also diminish (Kumbi, 2007).

Generally, WEPs are threatened due to various human activities and natural causes such as habitat distraction (timber harvest, fuel wood collection, forest fire), over harvesting, over grazing, land use change/expansion of agricultural lands, developmental activities, invasive species and climate change. According to Birhanu and Molla (2017) in Benishangul Gmuz currently some of the remnant forests with large numbers of the wild edible plants are subjected to frequent deforestation by the local community. This is attributed mainly to human population pressure and its associated effects. Agricultural land expansions, wild fire, fuel wood collection, overgrazing, and overharvesting are the main reasons for the destruction of wild edible plants. As elsewhere in Ethiopia, the problem is manifested in Kofale districts due to the above-mentioned factors.

2.3.2. Conservation of Wild Edible plants

Cultivating wild edible plants in home gardens and conserving and protecting them in the wild/ natural setting (in situ) is important to guarantee future access to wild edible plants for dietary supplements and for the healthcare system of local people and for laboratory investigations to obtain new chemical-lead findings. Conservation refers to the wise use and appropriate management of natural environment and its natural resources. Agricultural land expansion, fuel wood collection, and charcoal setting are the major threats to the conservation of wild edible plants in the study area. This was indicated that a good practice for the conservation of wild edible plants through cultivation (Mosissa, 2017).

The study indicated that local communities give priority to the immediate use of the wild food plants than to its sustainable future uses as a result their harvesting style is destructive. There are some conservation actions that have been undertaken around the world, this includes in-situ (in their natural habitat as in nature reserves and parks) or ex-situ (in field gene banks, botanic gardens or cold rooms (Tilahun and Mirutse 2010). This indicates that the necessary conservation measures are not being taken in the area, and

hence the wild edible plants are not free from threats (Birhanu and Molla, 2017).The conservation and management of wild plant resources problem is manifested in Kofale district as well.According to the informants responses some factors that hinder the development of conservation practices the study area were lack of community institution, lack of conservation advisor, absence of planting material(seedlings), soil infertility and drought and results to less conservation efforts on conservation of wild food plants in the study area. This study is in line with the study of Chekol(2011). Despite the fact that, absence of institution is a significant problem in maintaining traditional wild food plants in the area.

3. MATERIALS AND METHODS

3.1. Description of the Study Area

3.1.1. Geographical location

This study was conducted in the Kofale District, located in the West Arsi Zone of the Oromia National Regional State, southeastern Ethiopia. The district is situated approximately 305 km southeast of Addis Ababa and 25 km from Shashemene town. Geographically, Kofale lies between 7°50'–7°9'N latitude and 38°38'–39°49'E longitude, south of the capital. The district has an elevation range of 1,500 to 3,000 meters above sea level (Kofale District Health Care Offices, unpublished data).

Kofale is bordered to the south by the Sidama region, to the southwest by the Kokosa district, to the southeast by the Dodola district, to the west by the Shashemene district, to the north by the Kore district, and to the east by the Gedeb Hasasa district (Figure 1). The district covers an area of approximately 661.0 km² and is made up of 40 rural and 3 urban Kebeles. Six rural Kebeles, Gurmicho, Bitacha, Germama, Guchi, Abbosa, and Tullo were selected for this study (Kofale District Agricultural and Rural Development Office, 2023).

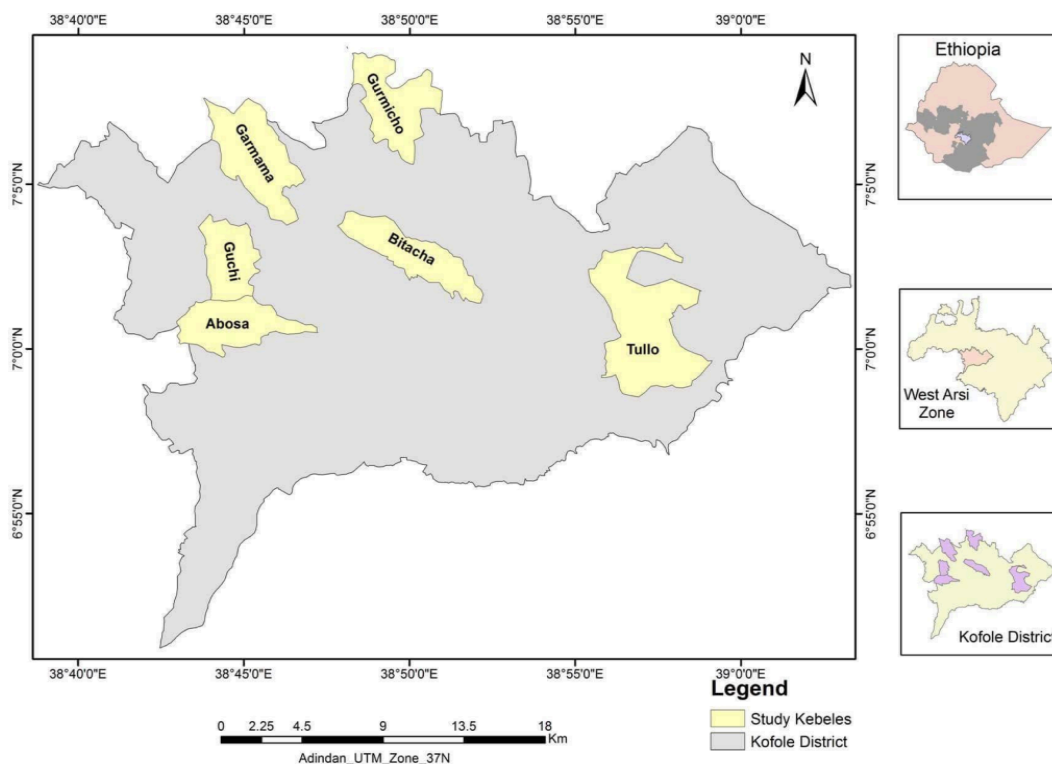


Figure: 1 Map of Kofale District, West Arsi Zone, Oromia Regional State, Ethiopia

3.1.2. Topography and Soil of the Study Area

The Kofale District is characterized by an altitudinal variation ranging from 2,200 to 2,300 meters above sea level, covering a total area of 70,229 hectares (KDARDO, 2023). The district features a diverse landscape with plains, hills, valleys, and gorges. The highest peak in the area is Mount Duro, reaching an elevation of 3,050 meters. The district's terrain spans from 2,000 meters (the lowest point) to 3,050 meters above sea level (the highest point). Kofale is drained by two major river basins: the Wabe Shebele and Lakes basins. In addition, several intermittent and perennial rivers flow through and out of the district. The main rivers include Kure, Remisa, Wabe, Arsasa, Anjelelo, Gimdolojo, Totolamo, Hesa, Ashoka, Abiyo, Lala, Kiro, and Gite. The upper catchment areas or headwaters of these rivers are predominantly located in Kofale, with the rivers originating from the district's highlands and flowing outward into surrounding areas. According to the Kofale District Agricultural and Rural Development Office (KDARDO, 2023), the dominant soil types in the area include clay (17.4%), clay loam (0.6%), clay to clay loam (63.5%), loam to clay (0.7%), and silt clay (17.8%). Among these, clay to clay loam soils are the most prevalent and are particularly suitable for the cultivation of cereal crops.

3.1.3. Agroecology and Climate condition of the study area

Agroecology: Kofale is one of the districts in the Oromia region of Ethiopia. The study area has good climatic conditions. According to Kofale district Agricultural and Rural development Office(2023), the climate of the area is classified traditionally into two main agroclimatic zones that mean, *Baddaa* (Highland)and *Badda daree* (Midland).Agroclimatic features of the district are mainly categorized into 85% highland and 15% middlelandclimates (KDARDO, 2023).The altitudinal range of the main agroclimatic zones are classifiedrespectively, into2300-3500 highland m.a.s.l, and1500–2300 midland m.a.s.l (Friis *et al.*,2010).Ninety percent of the total area in the district is 90% highland (2300–3500 meter above sea level) while 10% is midland (1500-2300 meter above sea level).

The rainfall distribution of the district is bimodal. According to climate data (2000–2017) from the center of the National Metrological Services Agency, NMSA,Kofale station, the

mean annual rainfall is 1107 mm; the peaks are between March and August and the beginning of September. The yearly mean annual temperature of the district is 13°C. At the same time, a dry season occurs from November to February. March to April and mid-June, the long rainy season, is also the time of flourishing and ripening wild edible plants. The highest rainfall occurs in July and August, the time of main cropping and growing cereal crops; later, rain decreases in September. Kofale district receives abundant and well-distributed rainfall both in amount and season, which is conducive for different types of vegetation growth and agricultural activities. On average, the district gets annual mean rainfall of maximum 2620mm, Average 1107mm. According to secondary data, the highest average maximum temperature of the study area in Kofale district is 21.9°C in the warmest month. The lowest average minimum temperature is 4.2 °C and is recorded relatively coldest month

3.1.4. Vegetation of the study area

The vegetation of the study area mainly falls into the dry evergreen afromontane forest and grass land complex (Hailemariam and Temam, 201). The natural vegetation of the study area is dominated by remnant trees like *Juniperus procera*, *Vachellia abyssinica*, *Ficus sur*, *Rosa abyssinica*, *Euphorbia abyssinica*, *Croton macrostachyus*, *Olea europaea* subsp. *cuspidata*, *Carissa spinarum*, *Bersama abyssinica*, *Rhus glutinosa* and *Eucalyptus globulus* among others.

3.1.5. Population of the study area

According to the projected report of the Central Statistical Authority (CSA, 2023), the total population of the Kofale district is 266,056, of which 132,954 are males and 133,102 are females. The largest ethnic group reported in Kofale district was the Oromo (97%); all other ethnic groups made up 3% of the population. Afan Oromo was the dominant first language, spoken by 98% of the inhabitants; the remaining 2% spoke all other primary languages. The majority of the people (94.4%) lives in the rural area by directly obtaining their means of subsistence from agriculture and associated activities while 5.6% of the people are urban inhabitants. More than 95% of the inhabitants are Muslims whereas 4% of the population practices Christianity. Afan Oromo is the predominant spoken language in the district (KDARDO, 2023). In Kofale district, mixed farming with livestock is widely practiced. Potato, barley, wheat, maize, *enset*, kale and

head cabbage are widely grown crop types in the district. Teff is also grown as an additional crop. Cultivation of Enset (*Ensete ventricosum* (Welw.) Cheesman.) is central to the cropping system on which the entire agricultural system is based, and the crop is the main source of food security and livelihoods (Olango *et al.* 2014). The district features a crop-livestock mixed farming system. Livestock like cattle, sheep, donkey, horse, and poultry production were practiced in the study area. According to the Kofale District Agricultural Office (KDAO), there are 106,325 cattle heads, 112,570 sheep, 91,400 horses, 9784 goats, 9410 donkeys, and 35,901 chickens in the district (KDAO, 2023).

3.1.6. Land use pattern of the Kofale district

Kofale district has various land use types that could be classified into arable land, grazing land and forest land. Kofale district has a total area of 70,229 hectares. From the total area, 61,389 hectares are covered by 43 kebeles centers and the remaining part is by rural. The land use pattern of the Kofale district shows that 33,599ha is cultivable, 21,631ha grazing land, 5,157ha is covered by forest, bushes, and shrubs, and 5,913 ha is being used for other purposes such as encampments and infrastructure facilities. From cultivated land about 7890ha for potato production in 2023 production year. The term land use implies the way the farmer allocates the land for their satisfaction of needs. It was classified as cultivable land, grazing land, irrigation land, swampy land, forest land and bush land. Cultivated land covers the largest share which accounts for about 58 percent of the total land, while grazing land was the second land use pattern that covers 31 percent of the total land (KDANRO, 2023).

3.2. Methodology

3.2.1. Study Design

A cross-sectional study design was used to collect and document the wild and semi-wild edible plants in Kofale district. This method is appropriate to describe emerging phenomena with the aim of justifying current condition and practice. Consequently, qualitative and quantitative study was conducted using key informant discussions to evaluate wild edible plants and associated indigenous knowledge of the people in Kofale district.

3.2.2. Selection of the study sites

Before conducting the actual data collection, study sites and informants were selected based on information gathered during reconnaissance survey from the administrative and agricultural offices. Study kebeles (the lowest administrative structures in Ethiopia) in the district were selected based on agroecological variations, history of use, and the availability of WEPs in the area. Accordingly, six kebeles, namely, Tulo (Highland), Abosa (Highland), Gurmicho (Midland), Guchi (Highland), Bitacha (Midland), and Germama (Midland) were selected because of their relatively high plant diversity in the region, the practice of traditional use wild edible plants, and recommendations of knowledgeable elders and kebele administrators.

3.2.3. Informant selection and sampling technique

The total kebeles in Kofale district is 43, among these, six kebeles were selected for sample sites. These kebeles are Tulo, Abosa, Gurmicho, Guchi, Bitacha, and Germama. From each kebele, 12 informants (including key informant) between the ages of 18 and above were considered. In this regard, a total of 72 informants (51 men and 21 women) were involved in the study, twelve of these were key informants (two from each site) following the choice of informant selection as recommended by Martin (1995). Key informants were selected purposefully based on the recommendations of elders, local authorities and local peoples. The rest of the 60 informants, ten per kebele were selected randomly when walking along in the study site (including altitudinal variation of the site). During field walking; informants were interviewed if he/she was willing. When informants were not willing, the interview was made with the next. As described by Alexiades (1996), repeated cross-checking and replication with the same informants was made at least twice in order to determine the degree of consistency of information.

3.3. Ethnobotanical Data Collection

The study was conducted from March 12, 2023 to June 1, 2024 to collect ethnobotanical data from the informants. The standard ethnobotanical data collection methods (Martin 1995; Alexiades 1996; Cotton 1996) were used to document wild and semi-wild edible plants knowledge of the local community. Different data collection tools were used for data collection such as semi-structured interviews, field observation, focus group

discussions, and market surveys.

3.3.1. Semi-Structured Interview

Semi-structured interviews were conducted to collect data from of informants. Semi-structured interviews with closed and open-ended questions were prepared in English and then translated into the local language (Afan Oromo). A list of questions based on the objective of the study was prepared which focused on the edible parts, harvesting time, occasions and modes of consumption, and additional uses of wild edible plants. Additionally, it included the local name of plants, and marketability of wild edible plants in the study area.

3.3.2. Focus Group Discussions

Group discussions were made earlier and during ethnobotanical data collection following Martin (1995). One group discussion, with five to seven participants, was conducted in one kebele with the general informants. The discussion emphasized on the status and use of wild edible plants, plant species and their use, the degree of dependence on them for livelihood during prolonged drought and famine, threats to wild edible plants, and conservation practices of common WEPs in their locality



Figure 2 group discussion of threats to and conservation practices of WEPs.

3.3.3. Field observations

Field observation was conducted in the study site with the help of guidance and interviewed informants where most of the WEPs are found. The purpose of field observation was to collect all the relevant data including identification of wild edible plant species (vernacular name of the plant); parts used as food and habitat distribution of WEPs. Field observations were performed with the help of key informants on the habit

and habitat of WEPs.



Figure 3. Wild habitats where edible plants were collected with the local guide

3.3.4. Market Surveys

Two markets were selected from the district. These markets are found in Kofale town and Robe Ashoka town. A market survey was conducted to record the names of wild edible plants within costs and other aspects of the edible parts being sold. Direct observations in the market and interviews on the aspects of wild plant products were conducted to identify wild edibles sold on the market following the methods described by Martin (1995) and Alexiades (1996). The survey was carried out to assess the variety and amount of wild edible plants supplied from the area and to record information that wild edibles are marketable for the use of remedies or for any other use.



Figure 4 .Leaves of *Urtica simensis* sold on the market of Ashoka town.

3.3.5.Collection and identification of wild edible plants

The reported WEPs were collected from natural vegetation during the field walks. Preliminary identification was done at the field. Moreover, it also recorded the local names of the plant species to aid the identification using Flora of Ethiopia and Eritrea. The identification was done mainly referring to Flora of Ethiopia and Eritrea (Bekele-Tesemma 2007; Edwards *et al.* 1995; 1997; 2000; Fichtl and Admasu 1994; Hedberg and Edwards 1989, 1995; Hedberg *et al.* 2004, 2006) were also used in the identification of the collected specimens and comparison with the already identified specimen used in a mini herbarium of Madda Walabu University. Finally, vouchers for the identified wild edible plant specimens were stored in the Madda Walabu University Herbarium. The identification was further refined and then cross-checked for taxonomic updates by referring to the website Plants of the World Online (POWO) and International Plant Index (IPI). Finally, all the identified specimens were collected, processed, and stored in the mini herbarium of Madda Walabu University.

3.4. Data Analysis

Ethnobotanical data were analyzed using descriptive statistics through Microsoft Excel spreadsheet software version 2016 following Cotton (1996) and Martin (1995). Ethnobotanical data were collected through interviews and FGDs were analyzed through descriptive statistics such as frequency and percentages using Excel spread sheets. The results are presented in tables and figures. In addition, Informant consensus, preference ranking, direct matrix ranking, index of fidelity level and Jaccard similarity coefficient were employed to analyze ethnobotanical data.

3.4.1. Informant consensus

Informant consensus was analyzed for ten most frequently reported wild edible plant species so as to identify the most cited wild plant species in the study area following Phillips *et al.* (1996) informant consensus describes the agreement between respondents when choosing the most cited specific wild edible plant species. It was used to evaluate and prioritize the reliability of the edible plants information during the interview; informants were contacted at least two times based on appointment made by them. Valid information was proved and recorded. Consequently, if the idea of the

informant deviated from the original information, it was rejected since it is considered as unreliable. Only the relevant ones were statistically analyzed following (Alexiades, 1996).

3.4.2. Preference ranking

Preference ranking of the WEPs was performed following Martin (1996) and Cotton (1995). In the preference ranking process, the values (1-5) were given by ten key informants, each value was summed, and the average was taken to determine the preference of one over the other. For the preference ranking exercise, informants were given the ten most preferred wild edible plants based on their taste and ranked according to their sweetness. The wild edible plant that was believed to have the sweetest fruit was given the highest value of five (5) was given to the most preferred species and the lowest value one (1) for the least. Preference classification was determined based on the total score of each species. Finally, total scores were added and then ranked to identify the most preferred plant species.

3.4.3. Direct matrix ranking

The direct matrix ranking (DMR) method was conducted for multipurpose use values of wild edible plants (WEPs) commonly reported by key informants (Martin, 1995; Cotton, 1996). DMR is one of the multifaceted types of preference ranking techniques. Based on the relative benefits obtained from each chosen six plant species, ten key informants were asked to assign values by giving order to each attribute among different uses such as charcoal, construction, medicinal, food, firewood, fence and fodder. Each chosen informant was asked to assign use values (5=best, 4 very good, 3 good, 2=less used, 1=least used). The average values of a score of each species were summed up and ranked. By adding the score values, it was possible to assess the relative importance and to check the major impacts due to the higher exploitation of each plant species than other species in the study site. Such data could be used for setting conservation priority.

3.4.4. Index of fidelity level

Index of fidelity level (FL) is a commonly used method to quantify, compare and determine the relative importance of a plant species for a given function (Alexiades, 1996). Fidelity level was used to quantify the importance of a species for a given

purpose using the following formula: $FL = Ip/Iu$ and $FL\% = (Ip/Iu) \times 100$, Where Ip is the number of informants who independently cited the importance of species for a particular purpose and Iu is the total number of informants who reported the plant for any given use.

3.4.5. Jaccard similarity coefficient

The Jaccard similarity index (JSC) was used to calculate the degree of similarity and difference in composition (Kent and Coker, 1992) of the WEPS among the Kebeles in Kofale district and with WEPS documented from other different study areas or districts. The Jaccard similarity index was calculated as follows. Where JSC = Jaccard's similarity coefficient, c is the number of species shared by or common to any pair compared in the Kebeles and Kofale district and other districts, and b and c are the numbers of WEPS reported solely in one of the compared groups (b for one group and c for the other).

$$JCS = \frac{C}{(a+b+c)}$$

3.5. Ethical Consideration

Ethical clearance was obtained prior to data collection. All the action was based on the cultural view of the local communities in the study area. Approaching of the informants is very systematic and it was based on the rules and norms of the local community by telling the fact and convincing each informant following his or her culture strictly. They are also informed that the objective of the research is not for commercial purposes and it is only for academic reasons. This is done by showing official letter from Madda Walabu University. All informants are voluntary and gave written permission. According to ethnobiology code of ethics indigenous knowledge should be protected and a part of the value generated should be transferred back to the authors of the knowledge. Finally, informants were accepted the idea and came to reach an agreement.

4. RESULTS

4.1. General Information of Informants

A total of 72 informants were selected from six study sites for data collection,

comprising 51 males (70.83%) and 21 females (29.16%). The majority of the knowledge regarding the traditional use of wild edible plants was provided by the males, with the remaining information reported by the females. This trend could be attributed to the fact that males are more involved in fieldwork activities, while females tend to have less involvement in such tasks. All informants were aged 18 years or older. Among the respondents, 36 (50.0%) were in the 18–40 years age group, 24 (33.3%) were in the 41–60 years age group, 8 (11.1%) were in the 61–80 years age group, and 4 (5.5%) were above 80 years old.

In terms of ethnicity, the majority of informants were of the Oromo ethnic group (55, 76.4%), followed by other ethnic groups (11, 15.3%). Regarding educational background, 34 (47.2%) informants had no formal education, 18 (25.0%) had completed primary education, 11 (15.3%) had secondary education, 5 (6.9%) held a diploma, 2 (2.7%) had a degree, and 1 (1.4%) had a master's degree (Table 1). When considering religious affiliation, the majority of informants were Muslim (54, 75.0%), followed by Orthodox Christians (15, 20.8%). The highest number of wild edible plants (WEPs) were mentioned by informants of the Muslim faith. In terms of marital status, 48 (66.6%) of the informants were married, 19 (26.4%) were single, and 5 (6.9%) were divorced. Regarding occupation, the majority of informants, 40 (57.1%), were farmers, 20 (27.7%) were traders, 8 (11.1%) were government employees, 3 (4.2%) were daily laborers, and 2 (2.7%) were engaged in other occupations (Table 1).

Table 1: General Information of Informants

Character	Categories	Frequency	Percentage
Gender	Male	51	70.8
	Female	21	29.2
Age	18-40 years	24	33.3
	41-60 years	36	50.0
	61-80 years	8	11.1
	Above 81years	4	5.5
Ethnicity	Oromo	55	76.4
	Amhara	11	15.3
	Gurage	2	2.7
	Silte	2	2.7
Educational status	No formal education	34	47.2
	Elementary school(1-8)	18	25.0
	Secondary school(9-12)	11	15.3
	Diploma	5	6.9
	Degree	2	2.7
	Master Degree	1	1.4
Religion	Muslim	54	75.0
	Orthodox	15	20.8
	Protestant	2	2.7
	Other	1	1.4
Marital status	Married	48	66.6
	Single	19	26.4
	Widowed	5	6.9
Occupation	Farmers	39	54.2
	Merchant	20	27.7
	Employed	8	11.1
	Daily laborers	3	4.2
	Other	2	2.7

4.2. Diversity of wild edible plants in the Kofale District

Forty-four wild edible plants used by communities in the Kofale district were documented. The WEPs were identified and documented belonged to 34 genera and 27 families. Moraceae was found to be a plant family with most five species used. Fabaceae and Rubiaceae were the second most common wild edible plant families with four species each, Lamiaceae and Rosaceae by three species each. The other families were represented by one or two species each (Table 2).

Table 2: List of the WEPs families and the number of genera and species in the study area

No.	Families	No. of genera	Percentage	No. of species	Percentage
1.	Amaranthaceae	2	5.8	2	4.5
2.	Anacardiaceae	2	5.8	2	4.5
3.	Apocynaceae	2	5.8	2	4.5
4.	Boraginaceae	2	5.8	2	4.5
5.	Fabaceae	2	5.8	4	9.09
6.	Lamiaceae	2	5.8	3	6.81
7.	Moraceae	2	5.8	5	11.3
8.	Polygonaceae	2	5.8	2	4.5
9.	Rhamnaceae	2	5.8	2	4.5
10.	Rosaceae	2	5.8	3	6.81
11.	Rubiaceae	2	5.8	4	9.09
12.	Solanaceae	2	5.8	2	4.5
13.	Other 15 families	10	29.4	11	25
Total	27	34	100	44	100

4.2.1. Growth habits of wild edible plants

Wild edible plants in the study area exhibit different growth forms. The growth form analysis indicated as shrub is the dominant growth habit contributing 18 species (40.9 %) followed by herbs 15 (34.1%) (Figure 5).

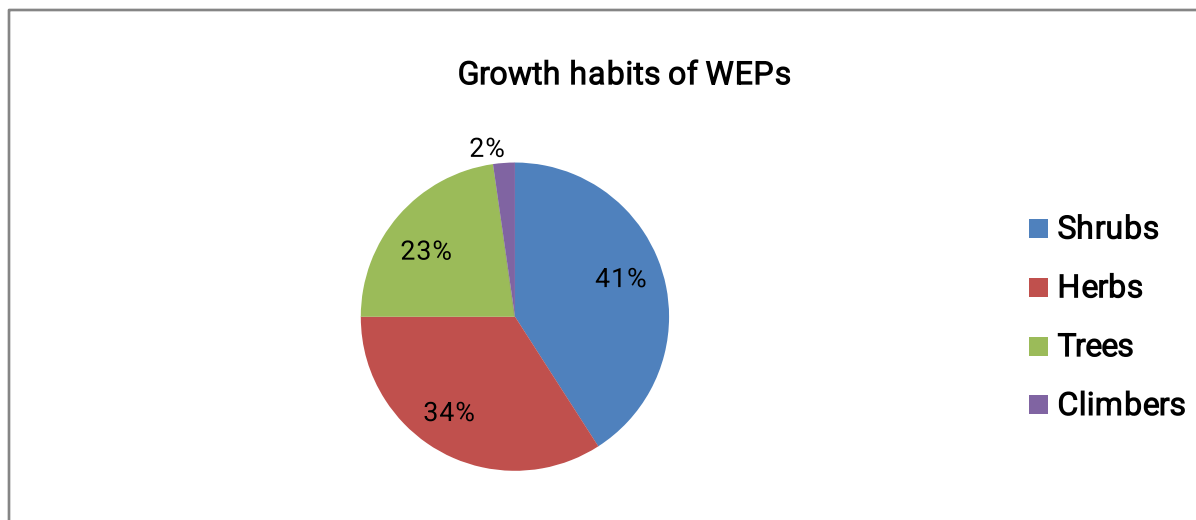


Figure 5: Growth habits of wild edible plants of Kofale District

4.2.2. Edible parts of wild edible plants in Kofale District

The local communities in the study area consume different parts of wild plants. Most plants consumed are ripe or cooked. Fruits were the most frequently consumed part of wild edible plants (Figure 6). The majority of fruits are consumed in raw (uncooked) when they ripe (Figure 6). From the reported wild edible plants some have two edible parts such as fruit and latex, and stem and root. For instance, *Cordia africana*, *Opuntia ficus-indica* and *Ficus sycomorus* fruits were widely consumed in the study area

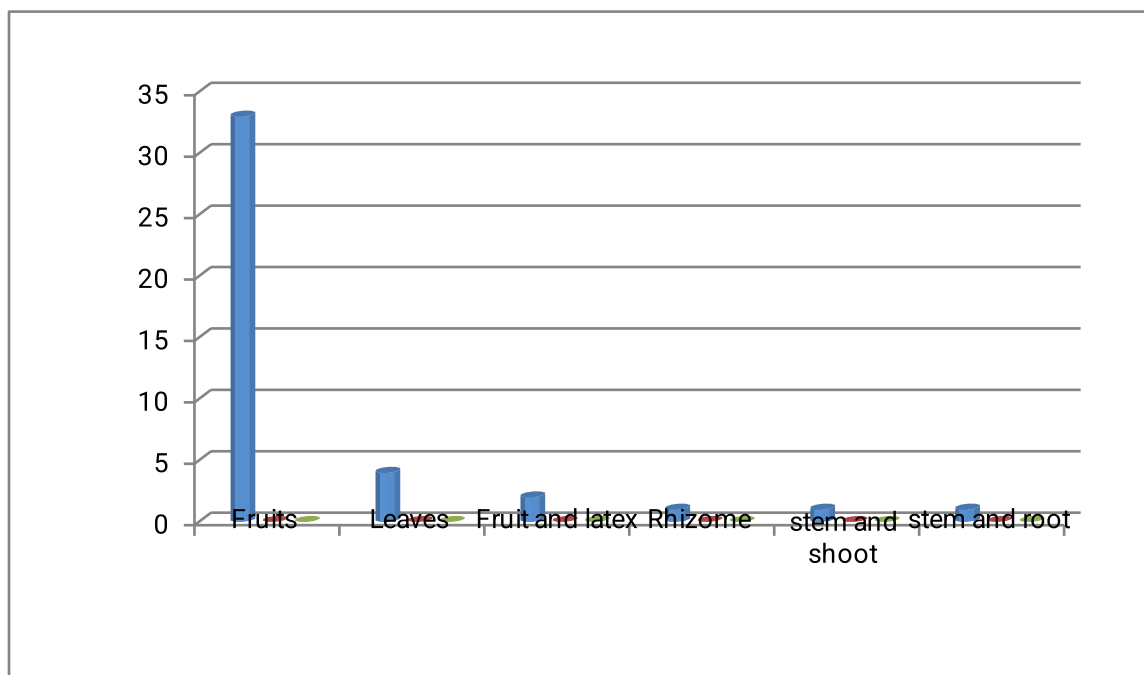


Figure 6: Edible parts of wild edible plants in Kofale District

4.2.3. Mode of consumption

Wild edible plants in the study area were consumed for supplementing staple foods and filling food gaps during drought and famine. About 36 (81.81%) species were reported to be eaten fresh (raw), followed by 7 (15.90%) species were consumed cooked or processed respectively (Figure 7).

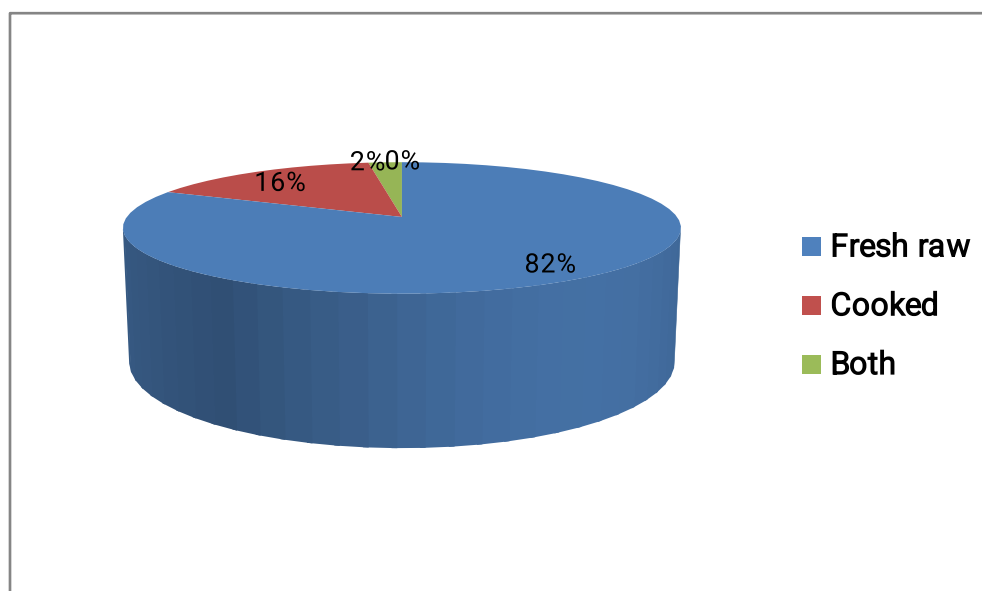


Figure :7 Mode of consumption of wild edible plants

4.2.4. Marketability of Wild Edible Plants in Kofale District

In the Kofale District, wild edible plants are rarely sold in local markets, with only a few plants being sold as food. The marketability and pricing of wild edible plants in the area were assessed. People typically collect wild fruits and sell them directly to retailers in formal markets, often earning a higher price by selling them to consumers in towns. *Opuntia ficus-indica* fruits, for example, are sold in local markets, contributing to household income. Only a small number of wild edible plants are observed in weekly local markets and daily urban markets. The market assessment revealed that many wild

edible plants are sold not only for food purposes but also for other uses, such as timber, agricultural tools, construction materials, and fuelwood. *Opuntia ficus-indica*, a notable species, is highly valued as timber and commands higher prices in local markets. Overall, the income generated from the sale of wild plant species plays an important role in supporting poor households by supplementing their food needs and other essential requirements.

4.2.5. Harvesting Periods of Wild Edible Plants

Wild edible plants are available year-round in the Kofale District. However, many species are most abundant during the autumn months (March, April, and May). In contrast, their availability is lower during the spring season (September, October, and November) (Table 3).

Table 3: Major seasons for harvesting WEPs in the Kofale district

S.N	Harvesting seasons	Frequency	Percentage	Rank
1.	Autumn (March, April, and May)	25	56.8	1
2.	Summer (June, July and August)	10	22.7	2
3.	Spring (September, October and November)	5	11.4	3
4.	Winter (December, January and February)	2	4.54	4
5.	Any time	2	4.54	4
Total		44	100	

4.2.6. Habitats of wild edible plants

The people in the Kofale district collected wild edible plants from various habitats. The majority of wild edible plants were documented from forest and Grazing lands areas followed by agricultural farm borders. Farm borders are less favorable for the growth of wild edible plants in the study area (Table 4).

Table 4: Habitats of wild edible plants in the study area

Habitats of WEPs	Frequency	Percentage (%)
Forest	32	72.72
Grazing lands/field	10	22.72
Farm land	2	4.54
Total	44	100

4.3. Importance of WEPs in the Study Area

4.3.1. Informant Consensus of WEPs

Informant consensus refers to the level of agreement among respondents when identifying the most frequently mentioned wild edible plant species. It was used to assess and prioritize the reliability of edible plants in the study area. Some wild edible plants were more widely known than others. As a result, local informants consistently mentioned certain plants as important supplementary foods to the staple diet. For instance, *Cordia africana* was the most frequently cited plant, with 58 (80.55%) informants acknowledging its food value, followed by *Opuntia ficus-indica*, which was cited by 56 (77.78%) informants (Table 5).

Table 5: Informant consensus on the most frequently used WEPs in the study area

Wild edible plant species	No. of Informants	Percentage of (%)	Rank
<i>Cordia Africana</i>	58	80.55	1.
<i>Opuntia ficus indica</i>	56	77.78	2
<i>Syzygium guineense</i>	48	66.67	3
<i>Urtica simensis</i>	46	63.89	4
<i>Ficus sur</i>	41	56.94	6
<i>Ficus sycomorus</i>	30	41.67	7
<i>Physalis peruviana</i>	45	62.50	5
<i>Anethum graveolens</i>	28	38.89	8
<i>Amaranthus dubius</i>	26	36.11	9
<i>Carissa spinarum</i>	25	34.72	10

4.3.2. Preference ranking

To do this, six most preferred wild edible plants based on their taste were given to the informants and they were ranked based on their sweetness. The wild edible plant that was believed to have the sweetest fruit was given the highest value of 5, and the one with the least sweet a value of 1. Preference ranking was determined based on the total score of each species. The total rank of preference exercise was obtained by adding the number given by each informant. As a result, the fruit of *Cordia africana* was ranked first and the fruit of *Ficus sycomorus* was ranked last.

Table 6: Preference ranking of WEPs used in the Kofale district

List of WEPs	Informant (R1-R10)										Total score	Rank
	R1	R2	R3	R4	R5	R6	R7	R8	R9	R10		
<i>Urtica simensis</i>	2	2	4	3	3	3	3	3	3	2	28	3rd
<i>Syzygium guineense</i>	2	3	3	4	2	3	2	2	2	1	24	4th
<i>Opuntia ficus indica</i>	4	4	3	4	4	3	4	4	4	3	37	2nd
<i>Ficus sycomorus</i>	1	3	2	2	1	3	1	1	2	2	18	6th
<i>Cordia africana</i>	5	5	5	5	5	5	4	5	5	4	48	1st
<i>Amaranthus dubius</i>	3	2	2	2	1	2	3	1	2	3	21	5th

4.3.3. Direct Matrix Ranking

As a result, species such as *Cordia africana*, *Syzygium guineense*, and *Carissa spinarum* were found to be highly exploited, leading to local extinction risks and endangerment due to unsustainable usage for various functions. The ranking results indicated that the use-value priorities for wild plants were as follows: firewood collection ranked first, followed by construction, charcoal production, medicine, food, fodder, and fencing, respectively. The direct matrix ranking was conducted by evaluating six plant species against seven usage criteria: medicine (Md), firewood (Fw), food (Fo), construction (Co), charcoal (Ch), fence (Fe), and fodder (Fd). The evaluation scale used ranged from 5 (best) to 1 (least used). Based on the data gathered from the informants, seven multipurpose plant species were selected from the Kofale district. The average use values for each species across all usage categories were calculated for each key informant, and the summed scores were used to rank the species (Table 7).

Table 7: Direct matrix ranking for multipurpose WEPs in the Kofale district

Wild edible plants	Use categories								
	Fo	Co	Ch	Md	Fw	Fe	Fd	Total	Rank
<i>Ximenia Americana</i>	3	2	4	2	3	2	2	18	5 th
<i>Ficus sycomorus</i>	2	3	5	3	4	4	1	22	4 th
<i>Opuntia ficus-indica</i>	2	2	2	2	2	2	2	14	6 th
<i>Syzygium guineense</i>	2	5	2	4	5	4	5	27	2 nd
<i>Cordia africana</i>	5	5	3	4	5	3	5	30	1 st

<i>Carissa spinarum</i>	2	5	4	4	5	2	3	25	3 rd
Total	14	20	18	17	22	15	16		
Rank	7 th	2 nd	3 th	4 th	1 st	6 th	5 th		

4.3.4. Fidelity level index

Fidelity level (FL) quantifies the importance of a species for a given purpose. Hence, fidelity level values were calculated for the following most commonly used individual wild edible plants at different times to fulfill food requirements. These wild edible plants had the highest FL values which could be an indication of their potential value as food. The eight potential WEPs were quantified using the index of fidelity level (Table 8). The ripening and availability of these species varied and were mainly used to fill gaps in food shortages. *Opuntia ficus-indica*, *Amaranthus dubius* and *Urtica simensis* had higher scores and were used as more regular wild food sources including *Physalis peruviana*, *Cordia africana*, *Ficus sycomorus*, *Amaranthus caudatus* and *Carissa spinarum* were reported for use as supplementary wild food sources. Both *Opuntia ficus-indica* and *Urtica simensis* were noted for being used as additional and regular wild edibles, particularly during famine and the food insecurity gaps. These species required sustainable use and conservation priority in the community of the study area

Table 8: The relative value of fidelity level for potential wild edible plants in the study area

Scientific name	Wild edibles used as supplements or regular wild food	I _P	I _U	FL	%	Rank
<i>Opuntia ficus-indica</i>	Used during the famine as regular wild food	52	52	1	100	1
<i>Amaranthus dubius</i>	Used during the famine as regular wild food	40	48	0.83	83	2
<i>Urtica simensis</i>	Used during the famine as regular wild food	38	45	0.84	84	3
<i>Physalis peruviana</i>	Used as supplementary wild food	28	44	0.64	64	4
<i>Cordia africana</i>	Used as supplementary wild food	26	42	0.62	62	5
<i>Ficus sycomorus</i>	Used as supplementary wild food	22	38	0.58	58	6
<i>Amaranthus</i>	Used as supplementary wild food	18	36	0.5	50	7

<i>caudatus</i>						
<i>Carissa spinarum</i>	Used as supplementary wild food	14	34	0.41	41	8

4.3.5. Jaccard's similarity coefficient

The Jaccard similarity coefficient (JSC) was used to calculate the degree of similarity and the difference in composition of the WEPS among the six selected Kebeles in the Kofale district. The collected and documented WEPS from the Kofale district were compared with similar plants documented by other researchers from other study areas, the Kofale district had a higher Jaccard similarity index with the Arsi Robe district, east Arsi Zone, Ethiopia with (13.9%), followed by the *Bereke forest* (13.3), and the least similarity was observed with the study conducted in the Soro District of Hadiya Zone, southern Ethiopia with (6.8%) similarity (Table 10).

4.4. Threats and conservation of Wild edible plants in Kofale district

4.4.1. Threats to Wild edible plants

According to informants from all kebeles, several factors threatened wild edible plants in Kofale District. The main threat to wild edible plant resources mentioned by the respondents was agricultural land expansion, fuel wood collection, charcoal production, overgrazing, climate change and unsustainable use. Among these factors, the expansion of agricultural land was identified as the most prominent, followed by fuel wood collection (Table 9). Thus, widely used multipurpose WEPS were highly threatened due to their extensive uses for different purposes. This shows that human activities (anthropogenic factors) are the main threats to vegetation which causes the decline of multi-purpose indigenous wild food plant species.

Table 9: Factors threats to wild edible plants

Threats	Respondents (R1-R10)										Total	Rank
	R1	R2	R3	R4	R5	R6	R7	R8	R9	R10		
Agricultural expansion	4	5	3	5	4	4	5	4	3	3	40	1 st
Overgrazing	3	1	2	4	2	2	3	1	3	4	25	4 th
Firewood collection	5	5	4	3	2	3	3	3	3	5	36	2 nd
Charcoal production	5	4	3	5	3	3	2	3	4	3	35	3 rd

Climate change	2	2	3	1	2	4	3	1	1	2	21	5 th
Unsustainable use	2	2	3	1	2	3	2	1	1	1	18	6 th

4.4.2. Conservation of Wild Edible Plants

Local communities in the study area employ various indigenous management strategies to conserve wild edible plants (WEPs). Due to their multiple uses, these plants are allowed to grow freely in farmlands (e.g., *Syzygium guineense* and *Cordia africana*), along farm boundaries, and in watershed areas. Some species are also valued for providing shade, such as *Ficus sycomorus* and *Ficus vasta*. Community norms dictate that cutting valuable shrubs and trees, particularly for charcoal production, is strictly prohibited. In contrast, around 24% of WEPs are slightly conserved due to their additional uses beyond food. For example, some individuals maintain *Cordia africana* on their properties for its timber; a few cultivate *O. abyssinica* for house construction, fencing, making household utensils, and as a source of income; and others conserve *Ficus sycomorus* for its shade and its role as a support for hanging beehives.

5. DISCUSSIONS

5.1. Diversity of Wild Edible Plants in Kofale District

A total of 44 wild edible plant species were documented in Kofale District, demonstrating the extensive use of wild edible plants (WEPs) in the Oromia Regional State. The Moraceae family was the most represented, with five species, followed by Fabaceae and Rubiaceae, each contributing four species, and Lamiaceae and Rosaceae, each contributing three species. The Moraceae and Fabaceae families were the most prominent in this study. Similar studies have also highlighted the importance of the Moraceae family, with Anbessa et al. (2024) documenting seven species in Dibatie district, Metekel zone, Benishangul Gumuz Regional State, western Ethiopia, and Giday and Teklehaymanot (2023) reporting four species of Moraceae in Raya-Azebo District. Conversely, other studies, such as those by Biri et al. (2024) in Arsi Robe district, found Rosaceae to be the family contributing the most WEPs. Additionally, Anbessa et al. (2024) in Dibatie district and Tahir et al. (2023) in Mieso district reported Malvaceae as the primary family contributing to WEPs.

The number of WEP species recorded in Kofale District was higher than those documented in other Ethiopian studies, such as 36 species in Arsi Robe (Biri et al., 2024), 34 species in Bereke forest (Kidane and Kejela, 2021), and 41 species in Mieso district (Tahir et al., 2023). This higher number indicates the significant diversity of wild edible plant resources in the region and the heavy reliance of local communities on these plants. However, the number of WEPs recorded in this study was lower than in other regions of Ethiopia, where studies reported 50 species (Guzo et al., 2023), 64 species (Hankiso et al., 2023), and 54 species (Anbessa et al., 2024). Similarly, studies in Burkina Faso (Hahn et al., 2018) and Turkey (Cakir, 2017) reported 354 and 154 WEPs, respectively. These differences in reported numbers can be attributed to factors such as cultural practices, vegetation cover, and climate variations (Bortolotto et al., 2015). It also suggests that in areas with fewer recorded species, there may be a decline in wild edible plants and the associated indigenous knowledge.

The relatively higher diversity of WEPs in Kofale District suggests a strong relationship between local communities and these plants. Furthermore, the number of preserved WEPs in an area often depends on factors such as proximity to urban centers and the

lifestyles of the residents. Variations in species numbers are influenced by environmental factors (e.g., topography, soil fertility, and climate) and cultural practices, leading to certain plants thriving in specific areas. Despite the significant deforestation in the region, the study area maintains a notable diversity of wild edible plants, likely due to its varying agroecological zones. This finding indicates that the local people possess valuable

Table 10: Jaccard's WEP similarity index between the Kofale district and other study areas

Districts	A	C	JSC	%	Reference
Kofale District	44	-	-	-	The current study
Raya Azebo district	59	10	0.113	11.3	(Giday and Teklehaymanot, 2023)
Arsi Robe district	36	13	0.139	13.9	(Biri <i>et al.</i> , 2024)
Dibatie district	54	8	0.075	7.5	(Anbessa <i>et al.</i> 2024)
Bereke forest	34	13	0.133	13.3	(Kidane and Kejela, 2021)
Metema District	44	10	0.102	10.2	(Masresha <i>et al.</i> , 2023)
Soro district	64	8	0.068	6.8	(Hankiso <i>et al.</i> , 2023)
Quara district	36	6	0.070	7.0	(Tebkew <i>et al.</i> , 2018)
Mieso District	41	9	0.095	9.5	(Tahiret <i>et al.</i> , 2023)
Midakegn district	50	9	0.095	9.5	(Guzo <i>et al.</i> , 2023)
Kofale and Heban Arsi	62	12	0.137	13.8	(Nuro <i>et al.</i> 2024)

5.2. Growth Forms of Wild Edible Plants

The wild edible plant species identified in this study were categorized into four life forms: shrubs, herbs, trees, and climbers. Shrubs made up 40.9% of the total, while climbers represented only 2%. The diversity of growth forms in the study area revealed that shrubs were the most common, followed by herbs, trees, and climbers. Climbers were the least diverse among the edible wild plants. This result aligns with the findings of Ojelel et al. (2019), who also reported a dominance of shrub growth habits in Uganda. The predominance of shrubs and herbs in the study area is likely due to the accessibility of shrub species and the abundance of herb species in the region. In this particular study area, the majority of wild edible plants were shrubs and trees, suggesting that

woody species are more prevalent. This finding supports earlier research by Alemayehu et al. (2015) and Amente (2017). Additionally, studies by Tahir et al. (2023) in Mieso district, Ashegre et al. (2016) in Burji district, Abera and Belay (2022) in Sedie Muja district, and Alemneh (2020) in Yilmana Densa and Quarit districts, all noted a dominance of wild edible herbs. The higher frequency of shrubs and herbs in this study could be due to these growth forms being more common than trees in the area.

Despite the dominance of shrubs and herbs, wild edible trees were also prevalent in the current study, consistent with the findings of Kidane and Kejela (2021) in Berek district, Masresha et al. (2023) in Metema district, and Hankiso et al. (2023) in Soro district. Variations in growth habits across different studies may be attributed to differences in climatic conditions, topography, and altitude, as noted by Hankiso et al. (2023). Similar trends were observed in studies by Alemayehu et al. (2015) and Amente (2017) in western Ethiopia. However, this result contrasts with that of Tebkew et al. (2018) in northern Ethiopia, where trees were the dominant life form of edible wild plants, followed by shrubs. These differences highlight the variation in the growth forms of edible wild plants across regions, which could be influenced by the types of plant species present and the cultural practices of local communities.

5.3. Plant Parts Used and Mode of Consumption

In the Kofale District, various parts of wild edible plants (WEPs) were identified, highlighting the diversity of edible plant parts available in the area. Among these, fruits were the most commonly consumed plant parts. The study showed that fruits were the most widely used, with people consuming them raw without any cooking. This finding aligns with Ayele's (2017) study on wild edible plants in the Benishangul Gumuz, Kamashi district of Western Ethiopia, where fruits were also reported as the most consumed plant parts. Fruits are often favored for their sweetness and high sugar content (Bhatia et al., 2018), suggesting a preference for easily accessible and palatable options.

Similar findings were reported by Hinnawi (2010), who stated that fruits are the most important edible plant parts, largely because of their taste, convenience, and ease of consumption without processing. This conclusion is also consistent with Abebe et al. (2021), who found that fruits were more widely used than other plant parts in the Amaro

district of Southern Ethiopia. The high consumption of raw edible parts may be due to the preference for fresh consumption over more processed foods. Additionally, raw fruits are considered nutritious, as cooking can lead to the loss of essential nutrients. Studies in other parts of Ethiopia, including those by Addis et al. (2005) and Teklehaymanot and Giday (2010), have also confirmed the dominance of fruits as the most commonly consumed WEPs. The primary mode of consumption of these plants was fresh and raw, which is in line with Emiru (2021) in Dabo Hana District, Oromia Region, Southern Ethiopia. Focus group discussions and key informant interviews indicated that fruits were the most widely consumed and valued plant parts in the study area. Consistently, studies by Ashagre et al. (2016) and Sintayo and Zebene (2020) found fruits to be the most commonly consumed WEPs across various regions of Ethiopia.

In contrast, in the Meinit Ethnic Community of Southwest Ethiopia, leaves were reported as the most preferred part, followed by fruits, roots, tubers, and seeds (Abebe et al., 2021). Additionally, several studies have reported that fruits, such as those from *Ensete ventricosum* (Welw.) Cheesman, are highly valued for their edibility, especially the ripe fruits, although the stem is also used in some areas (Alemneh, 2020; Berihanu & Mola, 2017; Kidane & Kejela, 2021). *Ensete ventricosum* is known for its high starch and fiber content, making it an important resource in food security, especially during periods of climate stress (Borrell et al., 2023). Children were the primary consumers of fruits, often consuming them while herding animals in distant fields. In contrast, women were generally responsible for collecting and preparing green vegetables for household consumption. This aligns with findings by Regassa et al. (2015) and Tebkew et al. (2014), who observed that children typically gather fruits during outdoor activities, while women focus on other plant parts for domestic use. The availability of wild edible plants is highest when there is a sufficient supply of staple foods, suggesting that WEPs are often consumed as supplementary food when regular food supplies are plentiful.

5.4. Seasonal Availability of Wild Edible Plants

Consequently, collectors of WEPs need to be aware of their seasonal availability. However, in the current study, some WEPs were picked and consumed on a regular basis when ripe. These plants also become essential famine foods during times of food

shortage. For example, fruits of *F. palmate*, *F. sycomorus*, *F. vasta*, *M. kummel*, *F. sur*, *O. ficus indica*, *R. natalensis*, *R. glutinosa*, and *Z. spina christi* are among those most frequently used diets during periods of food shortage (Duguma, 2020).

5.5. Ranking of Wild Edible Plants

The preference ranking exercise was also calculated for the most preferred wild edible plants for their fruits. From the result, *Cordia africana*, *Opuntia ficus indica*, *Urtica simensis*, *Syzygium guineense*, *Amaranthus dubius*, *Ficus sycomorus*, *Physalis peruviana*, *Carissa spinarum*, *Ficus sur*, *Ximenia americana* were ranked from 1-10, respectively. Therefore, future detailed investigation on the nutritional values and safety of these fruits is required for better and wider usage of these species through domestication. Most of the WEPs were eaten as extra food rather than as regular meals (Guo et al., 2022). According to the ranking of the top ten WEPs by the ten key informants *Cordia africana*, *Opuntia ficus indica*, *Urtica simensis*, *Syzygium guineense*, *Amaranthus dubius*, *Ficus sycomorus*, *Physalis peruviana*, *Carissa spinarum*, *Ficus sur* and *Ximenia Americana* were ranked from 1 to 10, respectively. This finding indicated that a more comprehensive investigation into the nutritional and safety aspects of these fruits is necessary to ensure their sustainable utilization through cultivation and propagation (Asfaw et al., 2024).

The results of a direct matrix ranking exercise revealed that *Cordia africana*, *Syzygium guineense*, and *Carissa spinarum* were the top three multipurpose WEPs in the study area. The output of the direct matrix ranking exercise revealed that *Cordia africana* is an over-exploited wild edible plant in the study area. This indicates that proper conservation for such species is urgently required. Fuel wood collection is one of the major threatening factors to wild edible plants. This might be because of that most of the local people of the study area are dependent of fuel wood as a source of energy.

5.6. Indigenous Knowledge Variation on Use of WEPs

In Kofale district, male populations were more knowledgeable than females. This might be due to occupation difference, males highly interacting with wild edible plants during cow keeping, collection of timber for house construction. This was not true in the study by Regessa et al. (2015) in Chelia District, West-Central Ethiopia where Women were more knowledgeable than males. More knowledge of wild edible plants in the study area

was obtained from elder informants, when compared with the young people. Youths tend to bend towards modernity and new cultures, which they consider to be more advanced. In age group informants having age >35 listed more wild edible plants than age (18-40), likewise, illiterate informants knew more wild edible plants than literate ones and indigenous knowledge was much in married informants than that of single informants. This result did not agree with Ashegre et al.(2016) where he showed women and children usually going out into the field and forests to collect a variety of leaves, roots, seeds, and fruits. In found at Dheeraa Town in Arsi, Ethiopia. This significant difference between literate, illiterate, and key informants could be attributed to the influence of experience and the maximum degree of knowledge acquisition of wild edible plants in illiterate and key informants, as well as the impact of modernization on literate communities.

5.7. Threats to and conservation status of wild edible plants

The local knowledge about the nutritive composition and side effects of the WEPs is very scanty and little is known about adverse side effects such as toxicity originating from the WEPs. The diversity of WEPs and the associate indigenous knowledge in the area is declining gradually by different factors (including agricultural expansion, overgrazing and poor management, and lower emphasis towards safeguarding of indigenous knowledge) leading to local extinction of the species and the valuable knowledge. Therefore, to improve the natural diversity and to minimize the influence of the surrounding communities and to use the forest resources sustainably, public awareness and participatory community based management need to be encouraged by government and non-government organizations at all levels with urgent collection of germplasm by the professionals. At large, the plant species and the traditional culture of the community shall be preserved and acknowledged. Almost all WSWEPs are found in the natural forest, along river sides and in range land areas. Thus, local communities should be encouraged to cultivate multipurpose and widely used WSWEPs on their own land in the home gardens, mixing with crops in farmlands and live fences and promoting the establishment of local botanical gardens starting at least at the kebele level.

6. CONCLUSSIONS AND RECOMMENDATIONS

6.1. Conclussions

This study has identified 44 species of wild and semi-wild edible plants (WSWEPs) from 34 genera and 27 families that are consumed by the local community in the Kofale District, West Arsi Zone, Oromia National Regional State, Ethiopia. The study found that wild edible plants and associated indigenous practices remain integral to the local community's food culture. Most of the wild edible plants in this region are shrubs found in forests and wooded areas, with fruits being the most commonly consumed part. Additionally, the study highlighted a positive correlation between informants' age and family size with the number of WEPs mentioned, suggesting that older individuals and larger families have more extensive knowledge of these plants.

Beyond their nutritional value, these wild plants serve a variety of other functions, including uses for fencing, fuel, fodder, medicine, and furniture. However, many of these plant species are under threat due to unsustainable harvesting for fuelwood and other uses. Key species such as *Cordia africana*, *Syzygium guineense*, and *Carissa spinarum* serve multiple purposes, further increasing their vulnerability. The local people harvest the WEPs not only for food but also for construction, fire wood, livestock fodder and furniture. Particularly, WSWEPs such as *Hagenia abyssinica* and *Cordia africana* have multipurpose use within the local communities. The depletion of these plants could result in the loss of indigenous knowledge and a significant decline in the availability of these valuable resources.

To ensure the long-term availability of wild edible plants in the region, there is an urgent need for collaboration between local communities/natural resource managers. Effective conservation efforts, including both ex-situ and in-situ strategies, must be implemented to prevent these species from becoming critically endangered. Wild edible plants are vital during food shortages and droughts, contributing significantly to the food security and livelihood resilience of local populations. Given their multifunctional uses, it is essential to safeguard these plants and the traditional knowledge associated with them. Therefore, along with sustainable utilization and conservation of the existing WEPs of the study district, priority should be given on urgent collection, domestication and cultivation of the most threatened wild edible plant species of the study area.

6.2. Recommendations

Based on the findings of this study, the following recommendations are proposed:

1. **Conservation Training and Awareness:** It is crucial to provide conservation training and educational workshops to local communities, focusing on the preservation of indigenous biodiversity, particularly species that are declining or nearing extinction. Increased attention should be given to these species to ensure their survival.
2. **Community Collaboration for Conservation:** Workshops and training should be organized in collaboration with local institutions and agricultural offices. These workshops should aim to educate communities on the importance of conserving indigenous plants, while addressing the impacts of human activities, such as over-harvesting for fuelwood, and promoting environmental benefits.
3. **Protection and Breeding of Valuable WEPs:** WEPs with exceptional traits, such as high nutritional value or resilience, should be prioritized for conservation. Efforts should be made to protect these plants and explore the possibility of cross-breeding new varieties to enhance their sustainability. Additionally, comprehensive research on the mineral composition, nutritional value, and biological.

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APPENDICIES

Appendix 1: Checklist of questions to used as basis for discussion and interview

Part One: Personal Information

1. Date _____ Month _____ Year _____
2. Name of respondent _____
3. Sex: Male _____ Female _____
4. Age:-----
5. Occupation _____kebele_____
6. Religion: 1. Orthodox, 2. Muslim, 3. Other specify _____
7. Educationalstatus:1.Uneducated,2.Educated(Primary,secondary,Otherspecify)_____
8. Marital status: 1. Single, 2. Married, 3. Widow, 4. Divorced

Part Two: Ethnobotanical study of wild edible plants

1. Do you know any plant use in your area? 1. Yes, 2. No
2. What are the wild edible plants common to you in your area?
3. What is the local name of this particular wild edible plant?
4. Which part of the plant do you use? E.g. Leaves, stem, root, gum, fruit, seed, etc.
5. What is the life/growth form (habit) of the plant? E.g. Tree, shrub, herb, climber, etc.

Part III: Interview for Focus group interviewees

1. Did you use wild edible plants in your local area? If yes, how? If No, why?
2. List and rank the most popular wild edible plants? Which is abundant most? Why?
3. List the name of wild edible plants in your area
4. List wild food shrubs and trees found in the study area?
5. Where are the most common habitats for wild food plants?
6. Who are gathering and selling? [men] [women] children] Other uses of the WEPs
7. List and rank the wild edible plants you see in the market?
8. What is the significance of wild edible plants in your family?
9. List the plant species and the parts used as food?
10. List threats of wild edible plants and conservation methods, if any?

Appendix 2: Ethnobotanical wild edible plants diversity collected in Kofale District

SN	Scientific Name	Afaan Oromoo	Family	Habit	Coll.No.
1	<i>Acacia abyssinica</i> Hochst. ex Benth	Laaftoo	Fabaceae	Herb	TH-10
2	<i>Amaranthus caudatus</i> L	Raafuu sinbiraa	Amaranthaceae	Herb	TH-02
3	<i>Amaranthus dubius</i> Thell	Raafuu qinxaa	Amaranthaceae	Herb	TH- 11
4	<i>Asparagus africanus</i> Lam	Sariitii	Asparagaceae	Herb	TH- 05
5	<i>Anethum graveolens</i> L	Goomanaa	Apiaceae	Herb	TH-44
6	<i>Achyranthes aspera</i> L	Darguu	Amaranthaceae	Herb	TH- 13
7	<i>Brassica nigra</i> (L.) Koch	Goomanaa	Brassicaceae	Herb	TH-17
8	<i>Berseama abyssinica</i> Fresen.	Koraqaa	Melanthaceae	Tree	TH- 03
9	<i>Casimiroa edulis</i> La	Koshimii	Solanaceae	Herb	TH- 33
10	<i>Carissa spinarum</i> L.	Agamsa	Apocynaceae	Shrub	TH- 41
11	<i>Cordia africana</i> Lam.	Wodeessaa	Boraginaceae	Tree	TH-08
12	<i>Cucurbita pepo</i> L.	Basqulaa	Cucurbitaceae	Herb	TH-42
13	<i>Dovyalis abyssinica</i> (A.Rich.) Warb	Dhangaggoo	Flacourtiaceae	Shrub	TH-32
14	<i>Euclea schimperi</i> (A.DC) Andy	Mi'eesaa	Ebenaceae	Tree	TH-30
15	<i>Ensete ventricosum</i> (Welw.) Cheesman	Warqee	Musaceae	Herb	TH-43
16	<i>Ficus vasta</i> Forssk	Qilxuu	Moraceae	Tree	TH-37
17	<i>Ficus sur</i> Forssk	Odaa nyaataa	Moraceae	Tree	TH- 38
18	<i>Ficus sycomorus</i> L.	Luugoo	Moraceae	Tree	TH-04
19	<i>Ficus palmata</i> Roxb.	Harbuu	Moraceae	Tree	TH- 28
20	<i>Girardinia bulbosa</i> (Steud.) Wedd.	Arbooyyee	Urticaceae	Shrub	TH-31
21	<i>Momordica foetida</i> Schumacher	Nyaata Allaati	Cucurbitaceae	Climber	TH- 24
22	<i>Myrsine africana</i>	Qacama	Myrsinaceae	Shrub	TH- 27
23	<i>Mimusops kumme</i> Bruce ex. A.DC	Qolaatii	Sapotaceae	Tree	TH- 35
24	<i>Olea europea</i> L. subsp. <i>cuspidata</i>	Ejersa	Oleaceae	Tree	TH- 07

	(Wall. Ex G. Don) cif.				
25	<i>Opuntia ficus-indica</i> (L.) Miller	Adaamii	Cactaceae	Shrub	TH- 12
26	<i>Pyrenacantha malvifolia</i> Engl	Burii	Icacinaceae	Tree	TH- 15
27	<i>Premna schimperi</i> Engl.	Urgessaa	Lamiaceae	Tree	TH- 40
28	<i>Physalis peruviana</i> L.	Mojullo	Solanaceae	Herb	TH- 26
29	<i>Rumex nepalensis</i> Spreng	Shaabee	Polygonaceae	Herb	TH-19
30	<i>Rumex abyssinicus</i> Jacq	Shoshira	Polygonaceae	Herb	TH-01
31	<i>Rumex nervosus</i> Vahl	Shoshira	Polygonaceae	Shrub	TH-16
32	<i>Rosa abbyssinica</i> Lindley	Goraa	Rosaceae	Shrub	TH-20
33	<i>Rubus apetalus</i> Poir	Goraa	Rosaceae	Shrub	TH-23
34	<i>Rubus steudneri</i> Schwein	Goraa	Rosaceae	Laina	TH-22
35	<i>Syzygium guineense</i> subsp. <i>guineense</i> (Wild.) DC	Baddessa	Myrtaceae	Herb	TH-29
36	<i>Tragia pungens</i> (Forssk.) Mull.Arg	Doobbi	Euphorbiaceae	Shrub	TH-18
37	<i>Thymus schimperi</i> Ronn	Xoosinyii	Lamiaceae	Herb	TH-9
38	<i>Urtica simensis</i> L.	Doobbii	Urticaceae	Herb	TH-34
39	<i>Catha edulis</i> Forssk. ex Endl	Jimaa	Celastraceae	Tree	TH-14
40	<i>Hagenia abyssinica</i> (Bruce) JF.Gmel	Heexoo	Rosaceae	Tree	TH-32
41	<i>Nicotiana tabacum</i> L.	Tamboo	Solanaceae	Tree	TH-18
42	<i>Ximenia americana</i> L	Hudhaa	Olaceae	Tree	TH-21
43	<i>Phoenix reclinata</i> Jacq	Meexxii	Arecaceae	Tree	TH-39
44	<i>Ocimum lamifolium</i> Hochst. ex Benth	Damaakasee	Lamiaceae	Tree	TH-06

Appendix 3: List of WEPs, habit, part used, and mode of consumption in Kofale district.

Key: Hab= Habit (H-Herb, Sh, Shrub, T-Tree, Cl-Climber)

SN	Scientific Name	Localname	Family	Habit	Part Used	Mode of consumption
1	<i>Acacia abyssinica</i> Hochst. ex Benth	Laaftoo	Fabaceae	T	Gum	Chewed by children
2	<i>Amaranthus caudatus</i> L	Raafuu	Amaranthaceae	H	Leaves	Both L and S eaten either cooked or raw
3	<i>Amaranthus dubius</i> Thell	Raafuu	Amaranthaceae	H	Stem	Cooked and eaten
4	<i>Asparagus africanus</i> Lam	Sariitii	Asparagaceae	H	Leaves	Young leaf is cooked
5	<i>Anethum graveolens</i> L	Goomanaa	Apiaceae	H	Fruit	Ripe fruit is eaten
6	<i>Achyranthes aspera</i> L	Darguu	Amaranthaceae	H	Fruit	Ripe fruit
7	<i>Brassica nigra</i> (L.) Koch	Goomanaa	Brassicaceae	H	Stem	Cooked and eaten
8	<i>Berseema abyssinica</i> Fresen.	Koraqaa	Melanthaceae	T	Fruit	Ripe fruits eaten raw
9	<i>Casimiroa edulis</i> La	Koshimii	Solanaceae	H	Fruit	Ripe fruits eaten raw
10	<i>Carissa spinarum</i> L.	Agamsa	Apocynaceae	Shrub	Fruit	Ripe fruits eaten raw
11	<i>Cordia africana</i> Lam.	Wodeessa	Boraginaceae	T	Fruit	Ripe fruits eaten raw
12	<i>Cucurbita pepo</i> L.	Basqulaa	Cucurbitaceae	H	Fruit	Dried seed roasted
13	<i>Dovyalis abyssinica</i> (A.Rich.) Warb	Dhangaggoo	Flacourtiaceae	Shrub	Fruit	Ripe fruits eaten raw
14	<i>Euclea schimperi</i> (A.DC) Andy	Mi'eesaa	Ebenaceae	T	Fruit	Ripe fruits eaten raw
15	<i>Ensete ventricosum</i> (Welw.) Cheesman	Warqee	Musaceae	H		Leaves cooked as stew
16	<i>Ficus vasta</i> Forssk	Qilxuu	Moraceae	T	Fruit	Ripe fruits eaten raw
17	<i>Ficus sur</i> Forssk	Odaa n	Moraceae	T	Fruit	Fleshy ripe fruits

						eaten
18	<i>Ficus Sycomorus</i> L.	Luugoo	Moracea	T	Fruit	Ripe fruits eaten raw
19	<i>Ficus palmata</i> Roxb.	Harbuu	Moracea	T	Fruit	Ripe fruits eaten raw
20	<i>Girardinia bullosa</i> (Steud.) Wedd.	Arbooyyee	Urticaceae	S		Fleshy ripe fruits eaten raw
21	<i>Momordica foetida</i> Schumach	Nyaata Allati	Cucurbitaceae	C I	Fruit	Ripe fruits eaten raw
22	<i>Myrsine africana</i>	Qacama	Myrsinaceae	S h	Fruit	Ripe fruits eaten raw
23	<i>Mimusops kummel</i> Bruce ex. A.DC	Qolaatii	Sapotaceae	T	Fruit	Ripe fruits eaten raw
24	<i>Olea europea</i> L. subsp. <i>cuspidata</i> (Wall. Ex G. Don) cif.	Ejersa	Oleaceae	T	Fruit	Ripe fruits eaten raw
25	<i>Opuntia ficus-indica</i> (L.) Miller	Adaamii	Cactaceae	S h	Fruit	Ripe fruits eaten raw
26	<i>Pyrenacantha malvifolia</i> Engl	Burii	Icacinaceae	T	Fruit	Ripe fruits eaten raw
27	<i>Premna schimperi</i> Engl.	Urgessaa	Lamiaceae	T	Fruit	Ripe fruits eaten raw
28	<i>Physalis peruviana</i> L.	Mojulloo	Solanaceae	H	Fruit	Ripe and uncooked
29	<i>Rumex nepalensis</i> Spreng	Shaabee	Polygonaceae	H	Fruit	Ripe fruits eaten raw
30	<i>Rumex abyssinicus</i> Jacq	Shoshira	Polygonaceae	H	Fruit	Ripe fruits eaten raw
31	<i>Rumex nervosus</i> Vahl	Shoshira	Polygonaceae	S	Fruit	Ripe fruits eaten raw
32	<i>Rosa abbyssinica</i> Lindley	Goraa	Rosaceae	S	Fruit	Ripe fruits eaten raw
33	<i>Rubus apetalus</i> Poir	Goraa	Rosaceae	S	Fruit	Ripe fruits eaten raw
34	<i>Rubus steudneri</i> Schwein	Goraa	Rosaceae	L	Fruit	Ripe fruits eaten raw
35	<i>Salvia nilotica</i> Juss.ex Jacq.	Xoosinyii	Lamiaceae	H	Fruit	Ripe fruits eaten raw
36	<i>Syzygium guineense</i> subsp. <i>guineense</i> (Wild.) DC	Baddessa	Myrtaceae	H	Fruit	Ripe fruits eaten raw
37	<i>Solanum nigrum</i> L	Tanboo	Solanaceae	H	Fruit	Ripe fruits eaten raw
38	<i>Tragia pungens</i> (Forssk.) Mull.Arg	Doobbi	Euphorbiaceae	S	Fruit	Ripe fruits eaten raw
39	<i>Thymus schimperi</i> Ronn	Xoosinyii	Lamiaceae	H	Fruit	Ripe fruits eaten raw

40	<i>Urtica simensis</i> L.	Doobbii	Urticaceae	H	Fruit	Ripe fruits eaten raw
41	<i>Nicotiana tabacum</i> L.	Tamboo	Solanaceae	T	Fruit	Leaf chew and grind
42	<i>Ximenia americana</i> L	Hudhaa	Olaceae	T	Fruit	Ripen and unripen
43	<i>Phoenix reclinata</i> Jacq	Meexxii	Arecaceae	T	Fruit	Fruit eaten
44	<i>Ocimum lamifolium</i> Hochst. ex Benth	Damaakas e	Lamiaceae	T	Fruit	Chewing leaf or liquid with water

Appendix 4 Photographs during Data collection

1) *Carissa spinarum*, Local name in Afan Oromo (Agamsa)



Plate 2) *Cordia africana* fruit, Local name in Afan Oromo (Waddeessa)



Plate 3) *Syzygium guineense* sub sp. *afromontum*, local name in Afan Oromo

(Baddeessaa)

