JIMMA UNIVERSITY

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ETHNOBOTANICAL STUDY OF WILD EDIBLE PLANTS IN DABO HANA DISTRICT, BUNO BEDELE ZONE, OROMIA REGIONAL STATE, SOUTHWEST ETHIOPIA

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A THESIS SUBMITTED TO DEPARTMENT OF BIOLOGY, COLLEGE OF NATURAL SCIENCES, JIMMA UNIVERSITY IN PARTIAL FULFILMENT OF THE REQUIREMENT FOR MASTER'S DEGREE IN BOTANICAL SCIENCE

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This is to certify that a thesis paper entitled as: ‘'Ethnobotanical Study of Wild Edible Plants in Dabo Hana District, Buno Bedele Zone, Oromia Regional State, Southwest Ethiopia” and submitted to Jimma University for the fulfilment of the degree of Master in Botanical Sciences and is a record of genuine research paper work carried out by Getachew Emiru Tao who was under our guidance and supervision.

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Abstract

Ethnobotanical study of wild edible plants in Dabo Hanna District, Buno Bedele Zone, Oromia Region, Southwest Ethiopia

Wild edible plants are valuable resources in rural livelihoods for supplementing the staple food, ensuring food security, for income, ecological and socio-cultural values. The aim of this study was to identify and document wild edible plant species of the study area and associated Ethnobotanical knowledge of local people related to uses of wild edible plants and assessment of the existing threats to these plants, as well as the conservation status of the local people of study area. Direct observation, semi-structured interviews, group discussion and questionnaires were employed to gather ethnobotanical data. For data analysis qualitative and quantitative Ethnobotanical methods were used. 86 respondents (59 males and 27 females) were selected from three study sites for data collection and 15 key informants were identified. A total of 31 of wild edible plant species belonging to 24 genera 22 families were collected and documented. The family Myrtaceae had the highest proportion comprise of four species and Moraceae and Acantaceae families were contributed three species each. While 4 families were consist of 2 species each (8 species), and the other rest 13 families consist only 1 species each. Among the documented wild edible plant species in this study, most of them were trees, 13(41.93%) followed by shrubs 12 (38.70), liana and herbs consist of 3 (9.67) species each. Fruits were the most frequently used parts whereas, nectar, tuber, bark and stem are less frequently used parts. These wild edible plants of the study area were under serious anthropogenic threats due to their multi-propose values like; medicinal, forage, food, firewood, construction, charcoal, fencing, and furniture making values, hence, need priority attention for conservation.

Keywords; *Wild edible, Ethnobotany, Indigenous knowledge, Dabo Hanna District*

Dedication

This dissertation is dedicated to:

This thesis is dedicated to the people of Dabo Hanna District, Buno Bedele Zone, Oromia Region, Southwest Ethiopia, who maintained their rich ethnobotanical knowledge associated with the wild edible plants for generations.

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1. INTRODUCTION

1.1 Background of the study

The long history of humans' ability to adapt to natural environments and interact with nature and social circumstances is profoundly attached to wild edible animals and plants. From the early hunter-gatherers and across different adaptation stages, plants have assumed great importance in human societies and many people all over the world have depended on many wild species particularly, for food and medicines (Alarcón *et al*., 2015 and Touwaide & Appetiti, 2015).

Wild edible plants (WEPs) are plant species that are neither cultivated nor domesticated, but are available from their wild natural habitat and used as sources of food (Beluhan and Ranogajec, 2010). Menendez *et al*. (2011) defined wild edible plants as "plants growing spontaneously in an area, i.e., without being cultivated, including native species as well as introduced species that have naturalized and which are ingested as food in the form of solids or liquids".

For at least one billion people of worldwide, wild edible plants are an important dietary component (Burlingame, 2000). Millions of people in many developing countries depend on wild resources including wild edible plants to meet their food needs (FAO, 2004 and Balemie & Kebebew, 2006).

Consumption of wild edibles is more common in food insecure areas than in other areas in the country (Teklehaymanot and Giday, 2010). Over 70% of the wild edible plants are consumed when food scarcity is high and at times of starvation (Tilahun and Mirutse, 2010). In many parts of developing countries, hundreds of wild edible plants are known to be sporadically consumed by rural communities (Getachew *et al.*, 2013).

About 5% of the total plant species of Ethiopian serve as food for human beings (Zemede and Mesfin, 2001). Wild edible plants of Ethiopia are also used as supplementary, seasonal or survival foods sources in many cultural groups, and hence play a role in combating food insecurity (Ermias *et al*., 2011). Ermias *et al.* (2011) compiled 413 wild edible plants belonging to 224 genera and 77 families in Ethiopia.

The principal role of these plants is to supplement the food obtained through home gardens and other forms of agriculture, many of the species grown or wild-harvested also provide vitamins, flavourings and so on of nutritional, gastronomic and social importance obtained from secondary products of metabolism such as alkaloids, essential oils and phenolics (FAO, 2010).

Throughout the world, and more especially in developing countries, wild plants make an important contribution to the life of local communities. Wild plants play a crucial role for daily requirement of human beings such as medicine, food, spices, fence and shelter construction and timber production (Acharya, 2010).

They play a significant part in a wide range of agricultural systems as a source of wild foods and fuel wood, and they have an important socio-economic role through their use in dyes, poisons, fibers and religious and cultural ceremonies. Many wild edible plants serve to generate household income to the poor households (Demel *et al*., 2010; Debela *et al*., 2011b and Neudeck *et al*., 2012).

Wild edible plants have also several indirect benefits such as sources of genetic diversity; encourages agroforestry practice in dry land areas; habitat for different organisms; rehabilitation of degraded lands; soil and water conservation as well as mitigation and adaptation to climate change (Demel *et al.,* 2010 and Debela *et al.,* 2011).

Wild edible plants face serious anthropogenic and environmental threats. Many threats are similar to those that affect plant diversity as a whole. The most common threats reported were agricultural expansion, overgrazing/overstocking, deforestation and urbanization (Addis, 2009 & Asfaw, 2009). The high nutritional value, the easy access, the lack of cares and the good organoleptic quality of wild edible plant species have led to their overexploitation even in natural forests which constitute the reservoir of WEPs species (Rigg *et al*., 2009). The effects of harvesting individual plants vary obviously according to what part of the plant is used (Cunningham, 2001).

FAO (2010) reported that, African forests' coverage decreases at an alarming rate due to human pressure. This forest degradation has been pointed out as one of the major reason of the progressive disappearance of WEP species in developing countries (Krusters *et al*., 2006).

Cultural patterns of decreasing wild edible plant use, associated with historical and contemporary socio-ecological changes, may strongly interfere with the transmission of ethnobotanical knowledge to new generations (Ladio, 2001). However, the continuation of traditional knowledge is endangered when transmission between the older and younger generation is no longer assured (Kargıoglu, 2008). Traditional knowledge (TK) of wild plants in Ethiopia also in danger of being lost as habits value systems and the natural environmental change.

Most of the ethnobotanical studies conducted in Ethiopia have focused on medicinal plants as compared to wild edible plants. Very little attention has been given to the inventory and conservation of the species (Getachew *et al*., 2005). There is a lack of information concerning their taxonomy, genetic diversity, and uses, among other aspects (IBC, 2005).

Therefore, this study was aimed to assess and document wild edible plants and associated ethnobotanical knowledge to these plants in Dabo Hana district, Buno Bedele Zone, Oromia Region, Southwest Ethiopia.

1.2. Statement of the problem

Ethnobotanical study of wild edible plants has great social and economic values for the societies, especially rural people. The community of the study area also uses wild edible plants for different purposes such as, supplementing the staple food, for food security, for income and medicinal values. Although, wild edible plant species and traditional knowledge associated with various plant resources are disappearing very fast due to;

- Lack of proper conservation strategy and
- Scientific documentation in the study area, and

The loss of valuable wild edible plant species is due to;

- Agricultural expansion,
- Charcoal production,
- Timber production,
- Overgrazing/overstocking and deforestation.

There is limited information is available on wild edible plants documentation, transfer of ethnobotanical knowledge and a sustainable use of these plants to next generation is less

available. Hence, there is a need to conduct ethnobotanical study to document WEPs and associated indigenous knowledge, threats & conservation status of with these plants in the District.

1.3. Objectives

1.3.1. General objective

- The general objective of this study was to assess and document wild edible plant species and associated ethnobotanical knowledge in Dabo Hana District.

1.3.2. Specific objectives

The specific objectives were;

1. To identify and document wild edible plant species those are used for food and other purposes in the Dabo Hana district
2. To document the ethnobotanical knowledge of the people of Dabo Hana district associated with wild edible plants.
3. To find out the threats and the methods used by the local people to conserve the wild edible plants.

1.4. Research questions

The following major research questions were conducted to be answered in this study:

1. Are there considerable numbers of wild edible plants that are traditionally used by the local people of Dabo Hana District?
2. What is the ethnobotanical knowledge of the people of Dabo Hana district associated with wild edible plants?
3. Which parts of the wild edible plants are more used to be eaten?
4. Which groups of the community commonly collect and used wild edibles (adult & old men, women or children)?
5. What are the major threats to wild plants in Dabo Hana District?

1.5 Significance of the study

The primary concern of this study was to investigate wild edible plants species that are found in Dabo Hana District, Bunno Bedele Zone. The findings of the study provide primary

information about wild edible plants species and to identify the local community study area awareness and attitude on wild edible plants. Thus, the findings of the study may help other researchers who may like to pursue further research on wild edible plants of the District and also help to recommend and design different strategies to reduce the impacts of local communities on wild food plants of the District. In addition, it may use for conservation and sustainable use of wild edible plants.

1.6 Scope of the study

The scope the study was delimited to Dabo Hana District, Buno Bedele Zone, Oromia Regional state, south western Ethiopia. The district bounded by Chawaka District in North, East Wollega Zone of Jimma Arjo district in the East, Bedele district in South and Mako, Dega districts and West Wollega Zone in West.

1.7 Limitation of the study

For purpose of implementing the collection of data for the conducted study, many challenges faced. Accordingly, the followings were the most challenging situations.

- Poor or little understanding of certain groups of community for the wild edible plants sues
- There was less interest in some individuals to share full information about wild edible plants
- Shortage of time and budget to reach each village/or individual of the district to get more information and species.
- Occasionally, environmental security problems occurred in some places.

2. LITERATURE REVIEW

2.1. Ethnobotany knowledge of Wild edible plants

Ethnobotany is the study of the inter-relationships between people and plants, particularly the way in which plants impact on human culture, and practices and how humans have used and modified plants, and how they represent them in their systems of knowledge. It is a multi-disciplinary science encompassing botany, anthropology, economics and linguistics which study the ways in which a society relates to its environment where indigenous knowledge and practices play significant roles in scientific disciplines (Cunningham, 2001).

These relationships can be social, economic, symbolic, religious, commercial, and artistic practices. The effect of harvesting individual plants will vary obviously according to what part of the plant is used (Cunningham, 2001).

Ethnobotanists performing field research today know that to fully understand and appreciate native plants, one must be knowledgeable both in the study of plants and in the observation of the indigenous culture (Young, 2007).

They aim to document, describe and explain complex relationships between cultures and issues of plants focusing primarily on how plants are used, managed and perceived across human societies as food, clothing, currency, rituals, medicines, dye, construction, cosmetics, and many more (Aiyeloja and Bello, 2006).

Ethnobotanical knowledge is a rapidly growing science. Hamilton *et al.* (2003) indicated that, the purposes and teaching of applied ethnobotany in the past have all too often been just academic exercises or have served only external interests, with the results benefiting neither local people nor conservation. But in the current approach it is cross-disciplinary, participatory, and geared towards local problem solving. The fundamental strengths of applying the approaches and methods of applied ethnobotany are that: they allow the knowledge, wisdom and practices of local people to play important roles in identifying and finding solutions to problems of conservation and sustainable development; local people are involved fundamentally in investigations so that there is a better chance of involvement; realistic case-studies serve as ways of balancing conservation with sustainable use and would help in developing appropriate policies towards their proper

implementation (Hamilton *et al.*, 2012). It is also worth remembering here that when knowledge of ethnobotany is integrated into indigenous knowledge and the scientific principles and concepts so as to attain both short-term and long-term aims, it is best referred to as ethnobotanical knowledge (Hamilton, 2003).

Zemede and Mesfin (2001) stated that some plant species are wild and others are slightly or strongly associated with humans revealing a living analogue of the wild-semi-wild domesticated continuum. Moreover, wild edible plants are considered Hidden Harvest and play a critical role in ensuring food and livelihood security for countless families and communities around the world (Demel *et al.*, 2010 & Badimo *et al*., 2015).

The aim of Ethnobotany is to study how and why people use and conceptualize plants in their local environments. Ethnobotanists gather data mainly from living peoples in hopes of gathering a view of their past-existence as well as an understanding of present uses of plants for food, medicine, construction materials, and tools.

Ethnobotanical research can be a door into cultural realities as well as a way to understand the future of human relationships with this land. The historical dimensions of ethnobotany that were largely listings of plants, names, and uses play a role in contemporary approaches to traditional plant knowledge. Most past researchers did not regard what the people thought about plants as important. The situation today is that researchers would like to include conceptualizations of plants in their studies, but do not have the methods to do this. This does not criticize ethnobotany, but rather attempts to build the framework upon which new methodological approaches can be explored (Salmon, 1999).

Over 20,000 species of wild edible plants in the world, yet fewer than 20 species now provide 90% of our food. However, there are hundreds of less well known edible plants from all around the world which are both delicious and nutritious. Wild edible plants are important as dietary supplements, providing trace elements, vitamins and minerals. However, consumption is determined less by calorie input and more by the pleasure of gathering wild resources, recreating traditional practices and enjoying characteristic flavours (Pardo *et al*., 2007).

2.2 Indigenous knowledge on wild edible plants

People of the world use the wild plant resources from the very beginning in ancient time to fulfil their needs (Uprety *et al*., 2012). Traditional knowledge of plants and their properties

has always been transmitted from generation to generation through the natural course of everyday life (Kargıoglu, 2008).

Indigenous people living in particular areas of the World depend on the use of wild plants or plant parts to fulfil their needs and often have considerable knowledge on their uses. The people generally depend on nearby forest areas to supply their needs. The biological resources are used in many ways: such as timber, fuel-wood, food, wild vegetables, spices, wild fruits, and often important medicines. Among them, WEPs play a major role in supplying food for poor communities in many rural parts of the world (Sundriyal *et al*., 2003).

Different wild edible plants have played a significant role in all geographical regions of world throughout human history (Sekeroglu *et al*., 2006). Further, they can be important socio-economically as dyes, shelter, fibers, and for sacred purposes (Abbasi *et al*., 2013). The use of wild edibles is a source of cultural identity, reflecting deep connections to the land and complex bodies of knowledge more widely known as traditional ecological knowledge about natural environments, survival, and sustainable living. The use of wild edible plants is contextualized in space and time, and dependent on several factors, such as species availability, site accessibility, cultural acceptability, and traditional ecological knowledge (Turner *et al*., 2011).

There is a difference between developing and industrialized countries in their habits of consumption of wild species. In developing nations, many edible wild plants are used as a source of food because the domesticated crop yield is not sufficient, whereas in most industrialized countries food supply is not a problem, thus wild plants are used to diversify a monotonous diet. Today, the concept of food in developed countries is profoundly modified. Indeed, consumers are no longer interested only in the supply of basic nutrients; they also demand the contribution of Nutraceutical compounds (Costanza, 2018).

Wild plants, aside from being used by poor communities, are commonly used today as a supplement for healthy diets in even the most developed regions of the world (Redzic, 2006). It has even been suggested that wild food plants are nutritionally superior to some of the cultivated ones (Burlingame, 2000). The use of wild plant resource still continued in different parts of the world. Because, the wild plants play a crucial role for daily requirement of human beings such as medicine, food, spices, fence and shelter construction, timber production, other (Acharya, 2010).

Present day modern people are ignorant about traditional food. The knowledge of traditional food with farmers, hunters and nomadic tribes is of great importance. These people had survived in extreme food scarcity periods from time immemorial (Swapnaja, 2019).

The use of wild edible plants is an ancient tradition that has been increasingly neglected (Cruz *et al*., 2013). Due to socio-economic changes, indigenous knowledge of plant uses has been eroded by globalization and modern lifestyles (Termote *et al*., 2011 & Meitei and Prasad 2013). At the same time, the loss of indigenous knowledge has been discovered to be one of the major threats to the sustainability of biological diversity (Keller *et al.*, 2005 & Ju *et al.*, 2013). Thus, documentation and evaluation of wild and semi-wild edible plants and related indigenous knowledge, carried out through ethnobotanical studies are urgently needed to preserve biological and cultural diversity (Heywood, 2011; Lulekal *et al*., 2011 & Luczaj *et al*., 2013).

The continuation of indigenous knowledge is endangered when transmission between the older and younger generation is no longer assured (Kargıoglu, 2008). Various studies suggested a need for urgent documentation of indigenous knowledge related to plants use as wild food to make it available to future generations (Addis *et al*., 2013).

2.3 Wild edible plants in Ethiopia

Ethiopia harbours two of the 34 global biodiversity hotspots (CI, 2004) and possesses one of the richest floras in Africa. The country is also considered as a center of origin and/or diversity for many field crop plants (IBC, 2012).Forests, grasslands, riverine environments and wetlands are home to numerous wild edible plants in the country (Asfaw, 2009).

In most parts of Ethiopia, wild edibles form integral parts of the feeding habits of many communities (Balemie and Kibebew, 2006). However, consumption of wild edibles is more common in food insecure areas than in other areas in the country (Teklehaymanot and Giday, 2010). For example, the Konso people in southern Ethiopia managed to endure three severe drought seasons of crop failure between 1996 and 1999 by consuming WEPs available in the region (Guinand and Lemessa, 2001). Tebkew *et al.* (2018), indicated that wild edible plants were consumed to supplement staple foods (about 70%) and fill food gaps (drought and famine, about 35%). Wild edible plants (WEPs) provide staple food for indigenous people; serve as complementary food for non-indigenous people.

2.4 Roles of Wild Edible Plants

2.4.1 Contribution in food security

On the World, consumption of wild edible plants has been "a way of life" for many rural populations (Ju *et al*., 2013). Edible wild plants play a critical role in ensuring food and livelihood security for countless families and communities around the world. Utilization of wild and semi-wild edible plants (WSWEPs) as a food source is an integral part of the culture of indigenous people around the world (Tilahun and Mirutse, 2010).

When compared to domesticated plant food sources, wild plant foods tend to be overlooked. However, there is substantial evidence that indicates the importance of wild edibles in terms of the global food basket. Since WEPs are freely accessible within natural habitats, indigenous people have knowledge of how to gather and prepare the foods (Somnasang and Moreno, 2000).

The food security issues are especially severe in the largely import-dependent countries of sub-Saharan Africa (FAO, 2011). In many parts of developing countries like Ethiopia, hundreds of wild edible plants are known to be sporadically consumed by rural communities (Getachew *et al.,* 2013). 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. Many WEPs in Ethiopia were reported as emergency, supplementary or seasonal food sources to avert food insecurity in households of Ethiopian cultural groups.

About 5% of the total plant species of Ethiopian plants serve as food for human beings (Zemede and Mesfin, 2001). The fruits of this plant are also sold in many local markets in the Tigray region of Ethiopia along with other cultivated food sources such as potato, carrot, bean and maize. *Amorphophallus gallaensis (Engl.) N. E. Br* and *Caralluma sprengeri N. E. Br.* were also reported for their role in fighting food insecurity during periods of drought and famine in Konso district (Guinand and Lemessa, 2000). This shows the role that WEPs of Ethiopia play at least at local levels, to combat food insecurity and their potential to address existing food insecurity at national level if properly managed. WEPs in Ethiopia that are reported to have nutritional and commercial properties that are valued in other countries (for

example, *Adansonia digitata L., Tamarindus indica L.,* and *Ziziphus mauritiana (Lam.)* are found to be underutilized in the country. Hence it is important that policy and decision makers consider all available ethnobotanical information on Ethiopian WEPs so as to develop regional and national plans for the conservation.

2.4.2 Income value

In rural areas in Sub-Saharan Africa, forest products contribute up to 46% of population's income (Mahapatra, Albers and Robinson, 2005; Assogbadjo *et al.*, 2009 & Fandohan *et al.*, 2010). Many wild edible plants serve to generate household income to the poor households (Demel *et al*., 2010; Debela *et al*., 2011b & Neudeck *et al*., 2012). They include wild edible fruit tree (WEFT) species which are treasured for their fruits, seeds, leave, barks, and roots (Belinda *et al*., 2013).

Some WEPs including: *Opuntiaficus indica (L.) Mille R, Moringa stenopetala (Bak. f.) Cufod, Sclero caryabirrea (A. Rich) Hochst and Leptadenia hastata (Pers.) Decne,* were reported to be available in rural markets of Ethiopia (Balemie and Kibebew, 2006, Addis, 2009), research on market chain analysis and economic value of these plants has not yet been addressed. A lesson on exploring the economic use of WEPs to supplement household income could be taken from the rational economic assessment of these plants from other countries such as Thailand and India (Delang, 2006 & Misra *et al*., 2008).

2.4.3 Other multi-purpose values of Wild Edible Plants

In addition to food wild edible plants have multi-purpose values in various ways such as forage/fodder, medicine, fuel wood (charcoal and firewood), material culture and miscellaneous uses (Tinsae *et al.,* 2013). They also serve as a shade for local community when they fetch water and conduct meeting. In addition, they protect the soil from erosion through their roots and protection. The rural community in the study area do not have any plantation for use in construction, protection and implements making and other alternative source of energy. They collect from forests and remnant trees in the farms and farm boundaries including WEPs such as *Z. spina-christi, F. thonningi, F. sycomorus, A. Digitata* and *T. Indica* (Tebkew *et al.,* 2018).

Plant tissues are considered as source of industry used in fibers for making cloth, rope, paper etc. Also, there are numerous dyes obtained from plants mixed with different materials. Many plants have oil-rich seeds that have a variety of uses. These oils can be extracted, many of

them are edible and they can also be used as Lubricants, fuel, for lighting, in paints and varnishes, as a wood preservative, waterproofing, other (Fern, 1997). There has been renewed or increasing interest in consuming wild food plants.

Throughout the world, and more especially in developing countries, wild plants make an important contribution to the life of local communities. They play a significant part in a wide range of agricultural systems as a source of wild foods and fuel wood, and they have an important socio-economic role through their use in medicines, dyes, poisons, shelter, fibers and religious and cultural ceremonies. wild edible plants have also several indirect benefits such as sources of genetic diversity; encourages agroforestry practice in dry land areas; habitat for different organisms; rehabilitation of degraded lands; soil and water conservation as well as mitigation and adaptation to climate change (Demel *et al.,* 2010 and Debela *et al.*, 2011).

Overall, the promotion of wild edible plants maintains the existence of biocultural heritage including valuable natural resources and the associated indigenous knowledge as well as their property rights (Debela *et al*., 2011).

2.5 Threats to Wild Edible Plants

Despite their importance, WEPs face serious anthropogenic and environmental threats. Many threats are similar to those that affect plant diversity as a whole. The most common threats reported were agricultural expansion, overgrazing/overstocking, deforestation and urbanization (Addis, 2009 & Asfaw, 2009).

The reported anthropogenic pressures in the country have resulted in a loss of thousands of hectares of forest that harbour useful WEPs. This loss was also reported to limit benefits gained from the plants and indigenous knowledge associated with these plants. The continuity of knowledge on the utilization of WEPs has also faced problems because of change in the feeding culture of the people (Teklehaymanot and Giday, 2010).

WEPs resources and their indigenous use are in danger of being lost in areas where environmental and cultural transformations have led to changes in feeding practices. Many indigenous communities abandon or change their traditional customs and thereby lose their plant knowledge over time (Benz *et al*. 2000; Byg and Balslev 2001 & Ladio and Lozada, 2003).

Natural resources applied by human are influenced by different factors such as history, cultural system and the availability (Ladio and Lozada, 2004). Unfortunately, many useful plants are threatened by habitat destruction and degradation, invasive species, climate change, pollution, and over-harvesting (Brummitt *et al.*, 2015) and are poorly represented in *ex situ* conservation repositories (FAO, 2010 & Khoury *et al*., 2010).

Changes in land-use due to urbanization and habitat destruction, as well as the slash and burn system of traditional farming with its associated shifting cultivation, have been causing forest destruction and degradation. For many indigenous peoples, historical and contemporary socio-ecological processes, such as land-grabbing, displacement and forest loss, have limited the use of wild edible plants. Processes of acculturation, migration, and lifestyle changes have replaced wild foods with industrialized foods (Delang 2006). Not only is the collection of wild edible plants a learning event, but so too are their preparation and consumption (Cruz, 2006).

Cultural patterns of decreasing wild edible plant use, associated with historical and contemporary socio-ecological changes, may strongly interfere with the transmission of ethnobotanical knowledge to new generations (Ladio, 2001).

2.6 Conservation of Wild Edible Plants

Many wild edible plant species are endangered due to genetic erosion (IBC, 2005). These phenomena are more pronounced in countries like Ethiopia where high rate of human population growth is compounded by insufficient documentation and conservation of biota that can safeguard promising plant taxa (Zemede and Mesfin, 2001). With the routine underestimation of wild foods, comes the danger of neglecting the provisioning ecosystems and supportive local knowledge systems that sustain these food chains (Grivetti and Ogle, 2000). The bulk of plant matter used for medicinal and wild food purposes is collected from natural vegetation (Melakeselam, 2001). However, as time goes by, the widely occurring wild edible and medicinal plant species and the associated traditional knowledge are being eroded.

Getachew *et al*. (2005) stated that in spite of the role of edible wild plants in bridging periods of food shortages and providing dietary variety, very little attention has been given to the inventory and conservation of these species.

Conserving Ethiopian WEPs *in-situ* (in their natural habitat as in nature reserves and parks) or *ex-situ* (e.g. in field gene banks, botanic gardens or cold rooms) is mandatory (Teklehaymanot and Giday, 2010). In order to successfully and safely use wild edible plants, it is necessary to know where specific plants grow, what the plants look like, what parts of the plants are needed, their seasonality, and techniques for harvesting, processing, and preparing them in sustainable ways (Ladio, 2001).

3. MATERIALS AND METHODS

3.1 Study Area

3.1.1 Geographical location

The study was conducted in Dabo Hana district, Buno Bedele Zone, Oromia Region, Southwest Ethiopia. The relative distance of the district is 519 km away from the capital city of the country, Addis Ababa, and 36 km from Bedele town. The district bounded by Chawaka District in North, East Wollega Zone of Jimma Arjo district in the East, Bedele district in South, Mako, Dega districts and West Wollega Zone in West. It is located between 36°5' 27" to 36°26' 19"E longitude and 8°30' 21" to 8°55' 20"N latitude. The district has 14 rural villages and one town administrative village.

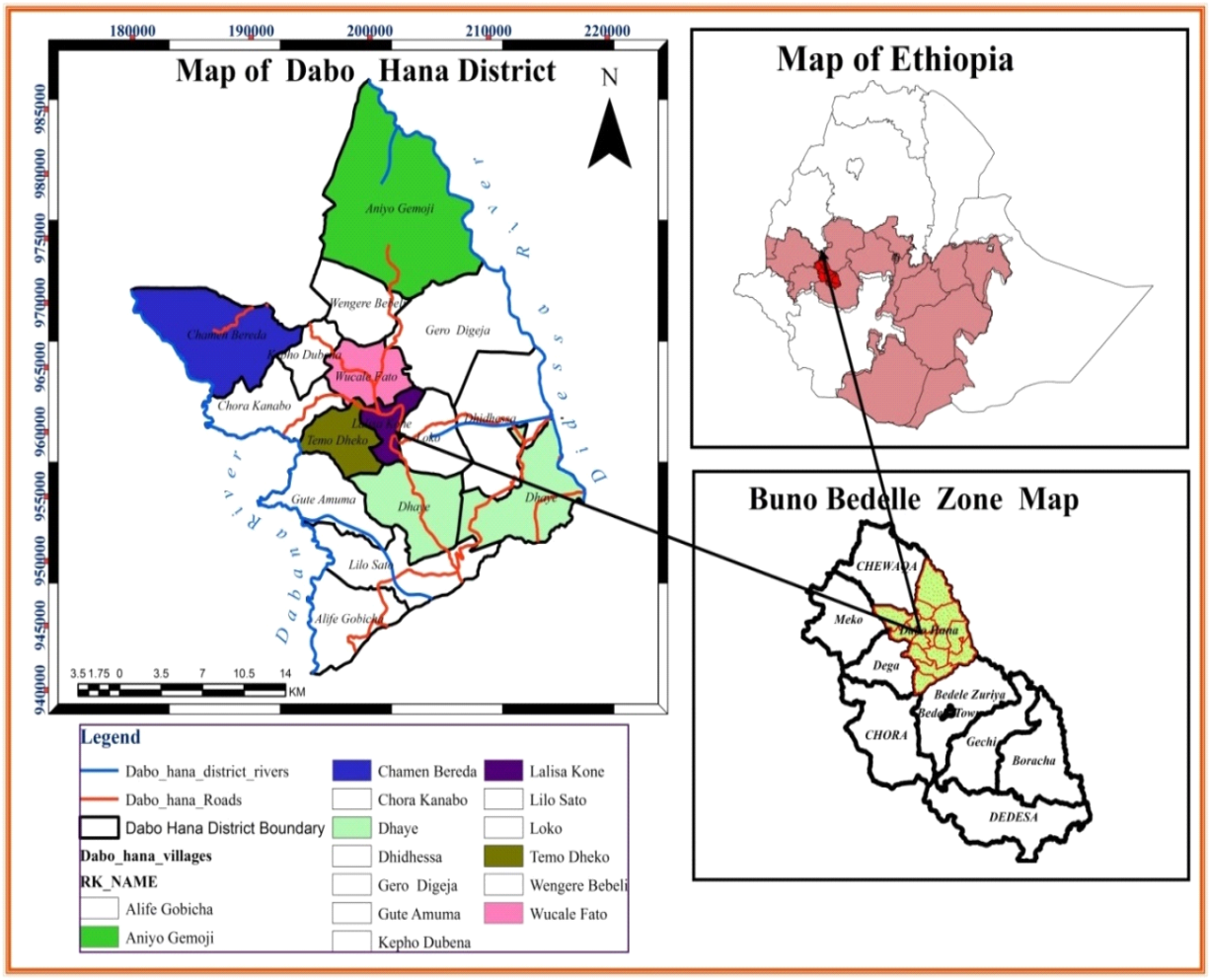

Figure 1: Map of the study area

(Source: Dabo Hana District Land use and Management Office, 2019)

3.1.2 Topography, Climate, Soil and Drainage of the Study Area

The topography of the District is characterized by the three major agro climatic zones within altitude range of 1190 to 2323 meters above sea level: highland (10%), middle land (70%), and lowland (20%).

The District has both dry and rainy seasons. The four major season of the District are winter (December to February), spring (April to May), summer (June to August) and autumn (September to November). The minimum temperature is 15°C, the maximum is 20°C and the annual average temperature is 17.5°C. The minimum rainfall is1518ml; the maximum is 1933ml, annual average rainfall 1675.5ml. The warmest month of the year is March with average temperature of 20.3°C in the area. The driest month is December with 14ml of rainfall and the most precipitation fall in August with average of 324ml (Ethiopian Metrological Agency from Bedele station, 2019).

The soil type of the study area is loam, sandy and clay soil and also endowed by several known rivers such as Loko, Urgessa, Afinda and Sadeni rivers. Dhidhessa and Dabana rivers are bound the District from east and west respectively (Dabo Hana district administrative office, 2019).

3.1.3 Vegetation of the Study Area

Dabo Hana District covers an area of about 74,718 hectares, of which about 18912.375 (25.31%) is covered by forests. The District has protected natural forest which covers an area of about 23,000 hectares and is under the protection of Oromia Forest and wild life organization called Abadiko natural forest.

Vegetation type of the study area is mostly evergreen. Data obtained from agricultural and rural development office of the study districts and field observation confirmed that the area is with scattered vegetation.

3.1.4 Population

Majority of ethnic group of the District is Oromo. There are also other ethnic groups such as Amhara and Tigre are living there. The dominant spoken language of the area is Afaan Oromoo (Dabo Hana Culture and Tourism Office, 2019). According to Dabo Hana Finance Office projected data, (2019) a total population of the District is 62297 of which 29396 (47.18%) are male and 32901 (52.81%) are female. About 3495 males, 3638 females totally

7133 (11.449%) of its population are urban; whereas, 25901 (46.95%) males and 29263 (53.04%) females and total 55,164 (88.56%) are rural dwellers. The majority of inhabitants practiced Ethiopian Orthodox Christianity 61.66%, whereas 29.13% are Protestant, 7.51% Muslim and the rest 1.7% are others.

The major economic activity is agriculture mainly in the rural population and the town populations are participate in trading activity (Dabo Hana Finance Office, 2019).

3.2 Methods

3.2.1 Sampling method

Three study sites were selected purposively from the villages of the District, based mainly on vegetation cover, and topographic variation of the sites. These three sites were: Dhaayee, Lookoo and Wangaree Baballii.

Informants were selected by systematic sampling method and key informants selected purposively from these three study sites. Key informants were informants having better indigenous knowledge regarding wild edible plants than informants. Thus, ethno-botanical data were gathered and the selection of informants and key informants was carried out based on prior information obtained from knowledgeable elders. Selection of informants was from different age groups, gender and field observation.

The determination of respondents from each village was according to their proportion of Household of each village. A total of 86 informants constituting 59 male and 27 females, between the ages of 18 and 80 were identified. 15 key informants (12 men and 3 women) were selected.

Informants' numbers were determined by using the formula (Mariano *et al*., 2012).

$$\mathrm{n} = \frac{\mathrm{Np}(1-\mathrm{p})}{(\mathrm{N}-1)(\frac{\mathrm{d}}{za}/2) + p(1-p)}$$

Where: n = approximate sample size;

N = the total population size of three villages households

p = proportion of population considered, to which it is assigned the value of 0.5

d = margin of error estimate; which is ≈0.09

α = level of significance considered 0.05

Zα/2 = value obtained from the table of Standard Normal Distribution 1.96

3.2.2 Data Collection Methods

The study was carried out through interviewing the knowledgeable informants and respondents in selected sites from March 10 to April 08, 2020, in selected Kebele of the District.

Guided field walk with informants and key informants from the selected sites, semi-structured interview, focus group discussions and market surveys were applied based on a checklist of questions prepared ahead of time were employed following (Martin 95 & Coton 96) and field observation was carried out with local field guide assistants. The selected informants in the sample site were interviewed using semi-structured interview focusing on the wild edible plants, their uses, threat of them and conservation methods.

A brief group discussion was made with the informants at each site on the status of the vegetation and acceptance of wild edible plants by the community. Full notes on facts and information about the respondents, history of wild food collectors, history of wild edible plants, and other essential information (based on the questionnaire) was recorded on site.

3.2.3 Voucher Specimen Collection

For ethical reasons, ethnobotanical data was collected in the presence of local administrators and with the permission of each informant. Collection of voucher specimens was made with the help of informants and local field assistants.

The specimens of all the wild edible plants identified by the informants were collected. Along with data collection, the field activities included taking notes on the plants and the associated indigenous knowledge with preliminary identification of the family and the species was take place. Information was captured with photographs to document the sites, individual plants and the edible parts. Each specimen was given a collection number and scientific and local name.

Sample specimens collected and pressed were taken to Jimma University herbarium where they were allowed to dry, deep-frozen and determinations was made using taxonomic keys and descriptions given in the relevant volumes of the Flora of Ethiopia and Eritrea

(Friis, 2006, Hedberg and Rosaceae, 1989). Finally, the plant specimens with labels were taken to Jimma University herbarium.

3.3 Data analysis

To analyze the Ethnobotanical collected data, both qualitative and quantitative analytical tools were used. Preference ranking, paired comparison, and direct matrix ranking were used following the approaches of Martin (1995) and Cotton (1996). Simple frequency tables and figures, Microsoft Excel spread-sheets were employed for organizing some ethnobotanical data.

3.3.1 Preference ranking

Preference ranking was performed to analyse and prefer wild edible plants. In preference ranking method, seven out of the total key informants were randomly selected and participated in the ranking exercise. Each of them ranked the selected six most popular wild edible plants based on their taste qualities according to their personal preference. The scores given to each species were added and the highest score was ranked to be first.

3.3.2 Paired comparison

After identifying some wild edible plants based on their high use values as perceived by a number of informants, paired comparison was employed as described by Martin (1995). A paired comparison was made among top five WEPs that were identified by the informants to be used as food obtained using ten informants to know their rank.

3.3.3 Direct matrix ranking

Direct matrix ranking was used to order wild edible plants by considering their several attributes once at a time. In this study six wild edible plant species based on their 8 general use values were selected. These were; medicinal, forage, food, firewood, construction, charcoal, fencing, and furniture making.

4. RESULTS

4.1 Informants demographic features

In this study, 86 (59 males and 27 females) respondents were selected from three study sites for data collection. 15 key informants were identified and 11 office personals were participated to provide information about wild edible plants of the study area.

Concerning the respondent's religious, 32 of them are Orthodox Christianity followers, 43 Protestant, 7 Muslim and 4 of them are other (table 1).

Table 1; Respondent's religious

Number of informants	Informant's religious				
	Orthodox Christianity	Protestant	Muslim	Other	Total
M	21	27	7	4	59
F	10	12	4	1	27
T	31	39	11	5	86
Percentage	36.05	45.35	12.79	5.81	100

The identified respondents were between the ages of 18 and 80. Out of 86 total informants involved in the present study, 19(22.09%) of the respondents were 18-30, 24(27.90%) were 31-43, 21(24.42%) of them were 44-56, 18(20.93%) were 57-69 and 4(4.65%) respondents were above 70 age (table 2).

Table 2: Age of respondents

Age category	Number of informants			Percentage
	M	F	T	
18-30	13	6	19	22.09
31-43	15	9	24	27.90
44-56	14	7	21	24.42
57-69	13	5	18	20.93
Above 60	4	-	4	4.65
Total	59	27	86	100

Regarding to the respondent's occupation, 11(8 male and 3 Female) are Government employee and 63 were farmers and 12 of them were students. The informant's educational backgrounds were categorized as; illiterate, Primary School (1-8), Secondary School (9- 12), Diploma and BA/BSC and above. Of these 41 of them were illiterate, 20 Primary School (1-8), 9 Secondary School (9- 12), 11 Diploma and 5 Degree holders (table 3).

Table 3: Educational background of the respondents of study area

	Educational level					Total
Gender	Illiterate	Primary School	Secondary School	Diploma	BA/BSC	
M	22	17	8	7	5	59
F	19	3	1	4	0	27
Total	41	20	9	11	5	**86**
%	47.67	23.25	10.46	12.79	5.81	**100%**

4.2 Taxonomic Diversity of Wild Edible Plants

In this study 31 wild edible plants species belonging to 24 genera and 22 families were identified by local communities of the study area and documented (Fig. 2 and Appendix II).

The family Myrtaceae had the highest proportion comprise of 4 (12.9%) species and Moraceae and Acantaceae families were contributed three species each (6 species). While, Appocynaceae, Capparaceae, Tiliaceae and Rosaceae families were consist of 2 species each (8 species), and the other the rest 13 families consist only 1 species each (figure 2).

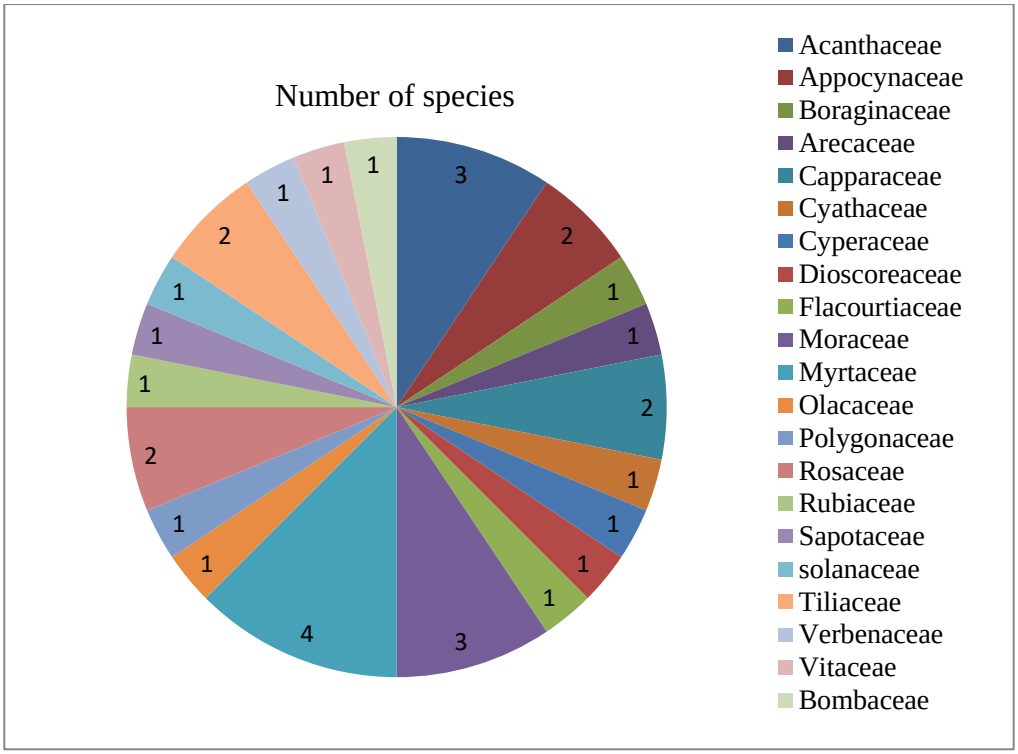

Figure 2: The dominant families of wild edible plants recorded from the study area.

4.3 Habits of Wild edible plants

Wild edible plant species of the study area were diversified depending on their growth forms. Most of them are trees accounting for 13(41.9%) species followed by shrubs 12(38.70%), and liana and herbs contain 3(9.67%) species each (figure 3).

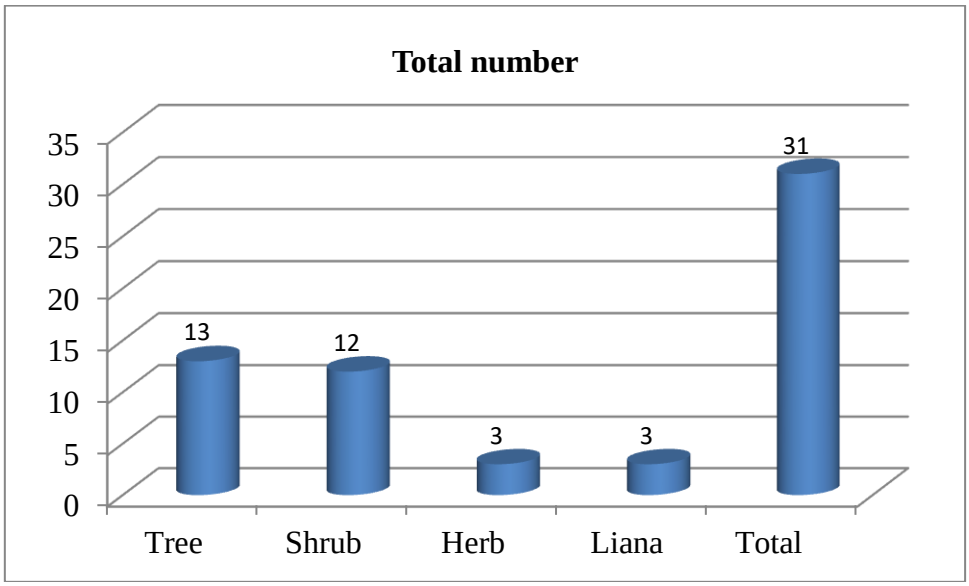

Fig.3: Growth forms of wild edible plants of the study area

4.4 Plant parts used

The edible parts of Wild edible plant species recorded in this study include; stem/shoot, fruits, nectar tuber and bark. Fruits are the most frequently used part which is 74.19%, whereas nectar, root**,** bark and stem are used less frequently (Figure 4 and Appendix II).

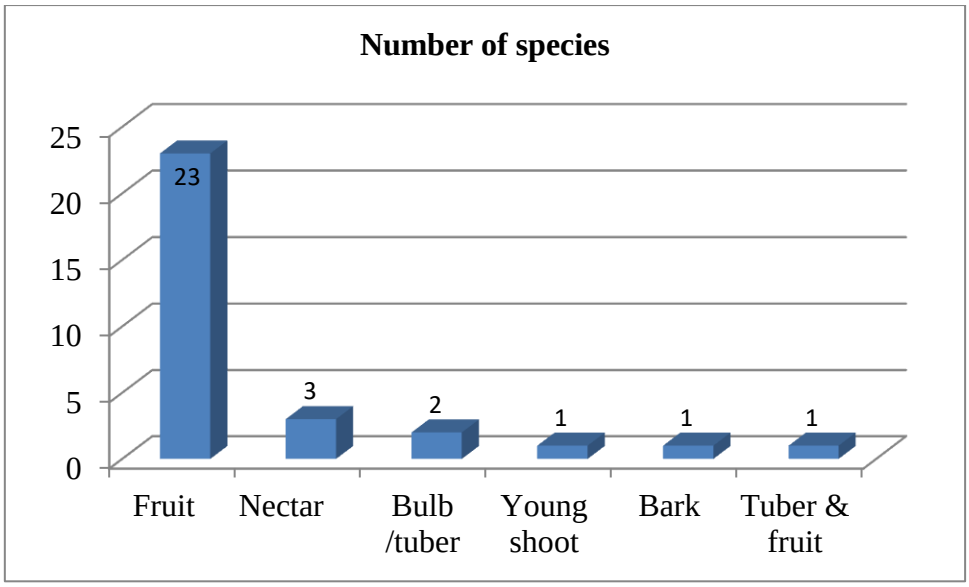

Fig.4: Plant parts used

4.5 Modes of consumption of wild edible plants

Most of the wild edible plants of the study area 27(87.09%) were reported to be consumed raw and some 4(12.91) of them require processing (figure 5).

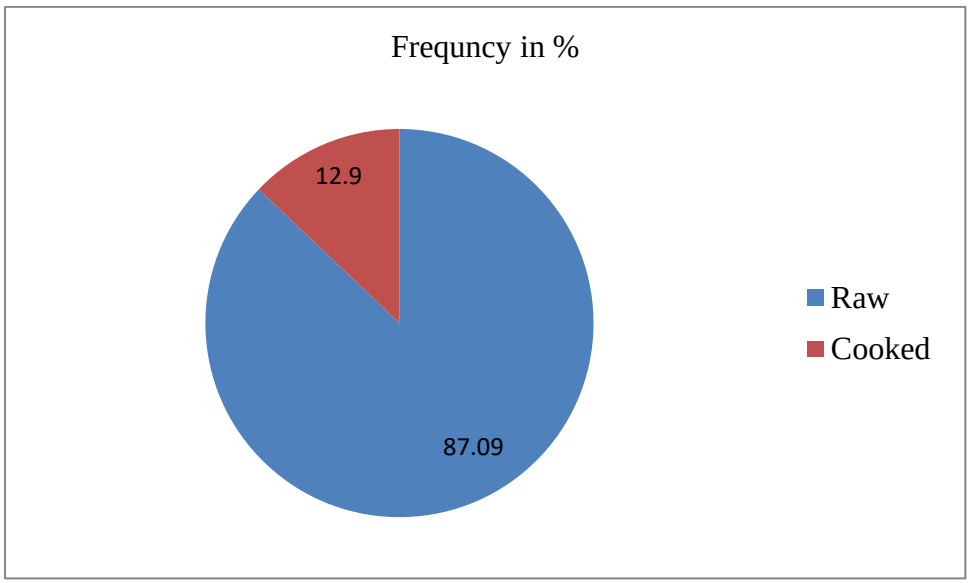

Fig.5: Modes of consumption of wild edible plants

4.6 Ways of preparation

According to information gathered from the respondents of the study area, most of Wild edible plants (83.87) did not need processing to be consumed (consumed raw), 1 species used after grinded, 1 by chewing and 3(9.67%) of them consumed after cooked (table 4).

Table 4: Ways of preparation of wild edible plants

Parts used	Ways of preparation and number of species of wild edible plants					
	Cooked	After grinding added to local beverage	Raw	Chewing	Total	%
Fruit	-	-	23	-	23	74.19
Bark	-	1	-	-	1	3.22
Young shoot	-		-	1	1	3.22
Tuber	2	-	-	-	2	6.45
Tuber & fruit	1	-	-	-	1	3.22
Nectar	-	-	3		3	9.67
Total	3	1	27	-	31	100
%	9.67	3.22	83.87	3.22	100%	

4.7 Ranking of wild edible plants of the study area

4.7.1 Preference ranking

The preference ranking of 6 wild edible plant species were taken based on their frequently usage and taste qualities and the key informants were asked to rank according to their personal preference. The scores given to each species were added and the highest score was ranked to be first. Accordingly, *Sysygium guineense* was ranked first.

Table 5: Preference ranking of six most popular selected WEP species used for food value

(5= for excellent, 4=very good, 3=good, 2= less and 1=least).

Respondents	Plant Species name					
	Acanthus Eminence	*Carissa spairanum L. (C. edulis)*	*Dioscorea bulbifera*	*Rubus apetalus Poir.*	*Sysygium guineense (Willd.) DC.*	*Sysygium oleosum*
R1	2	4	3	5	6	4

R2	3	3	5	6	5	5
R3	2	3	4	4	6	5
R4	1	4	5	6	4	4
R5	2	3	3	3	5	5
R6	1	2	4	4	6	4
R7	4	4	3	5	4	5
Total score	15	23	27	33	36	32
Rank	6th	4th	5th	2nd	1st	3rd

Note. "R" stands for respondent who participate in ranking method

4.7.2 Pair wise ranking

A pair wise ranking was made among top five WEPs that were identified by the informants to be used as food obtained using ten informants to know their rank. This result indicates that *Dioscorea bulbifera* is favoured much over other plant species cited in the study area as food plants followed by; *Cissus rotundifolia (Forssk.) Vahl, Sysygium guineense (Willd.) DC., Rubus apetalus Poir. and Capparis tomentosa Lam*. As indicated in table 6.

Table 6: Paired wise ranking of five wild edible plants used for regular food

(1=Least; 2=Good, 3=Very good; 4=Excellent).

No.	**Plants species**	**Respondents (R1-R10)**										Total	Rank
		R1	R2	R3	R7	R4	R5	R6	R8	R9	R10		
1	*Capparis tomentosa Lam.*	2	1	1	3	2	1	1	2	3	2	18	5th
2	*Dioscorea bulbifera*	4	4	2	3	4	3	3	4	4	3	34	1st
3	*Cissus rotundifolia (Forssk.) Vahl*	3	2	4	3	3	3	2	3	4	3	30	2nd
4	*Rubus apetalus Poir.*	2	3	2	2	3	1	2	3	3	2	23	4th
5	*Sysygium guineense (Willd.) DC.*	3	3	2	1	2	3	4	4	3	2	27	3rd

4.7.3 Direct matrix ranking

Direct matrix ranking was made based on the use diversities of wild edible plants which were selected by the key informants. Six wild edible plant species were selected based on their 6 general uses. These were; medicinal, forage, food, firewood, construction, charcoal, fencing, and furniture making.

Table 7: Direct matrix ranking of six wild edible plant species based on their 6 general uses

Average score for (5 = best, 4 = very good, 3 = good, 2 = less used, 1 = least used and 0 = not used

Plant species	Use categories								Total	Rank
	Med.	For.	Food	F. w	Constr.	Charc.	Fen	F. making		
Cyperus usitatus Burch.	5	5	5	2	4	0	4	2	27	6th
Cordia africana	4	4	5	5	5	3	4	5	35	1st
Ficus sycomorus L.	4	4	5	5	5	4	4	2	33	2nd
Grewia ferruginea Hochst. ex A. Rich	5	4	5	3	4	2	2	3	28	4th
Acanthus eminence	5	3	3	5	4	2	2	2	26	5th
Syzygium guineense sub sp guineense	4	4	5	5	4	4	4	2	32	3rd
Total	27	24	28	25	26	15	20	16		
Rank	2nd	5th	1st	4th	3rd	8th	6th	7th		

Note; Med. - medicinal, for.- forage, F. w-firewood , Constr.- construction , Charc.-charcoal, Fen-fence , F. making- furniture making.

4.8 Uses of Wild Edible Plants of the Study Area

Local people of the study area have wide range of indigenous ethnobotanical knowledge base that they have accumulated over generations. These knowledge arrays include the use of plants in health, food, various other livelihood services, as well as traditional natural resource management practices. Wild edible plants in the study area were found to have multi-purpose values in various ways such as medicine, forage, fuel wood (charcoal and firewood), material culture and miscellaneous uses.

4.8.1 Contribution in food security

Most of the indigenous people of the study area occasionally consider the wild edible plants as famine foods or foods in starvation period. Many of the recorded wild edible plants of the study area used as supplementary foods sources and were used for food during food scarcity period and hence play a role in combating food insecurity. As the result from respondents obtained shows, around 83.87% of the WEPs were used as supplementary food and the rest (16.129%) were used as food regularly or as meal.

4.8.2 Income value

In addition to their use for household consumption, the identified wild edible plants are marketable, and provide an opportunity to supplement household incomes in the study area and during the study; three major markets of the District were observed. These were; Lilloo, Kone and Tulamaa. About 6 (19.35 %) of the total species collected from the study area were reportedly great commercial value in the local market observed. Other wild edible plants were sold at villages and on the roadsides of the study area. These plants include *Sysygium zeylanicum, Sysygium oleosum, Cissus rotundifolia (Forssk.) Vahl, Dioscorea bulbifera, Ximenia americana L.* and *Capparis fascicularis DC.* These have great economic value in observed local market.

Table 8: List of marketable wild edible plants

No.	Wild edible plants	Parts marketed
1	*Cissus rotundifolia (Forssk.) Vahl*	Tuber
2	*Dioscorea bulbifera*	Tuber & Fruit
3	*Sysygium zeylanicum*	Fruit
4	*Sysygium oleosum*	Fruit
5	*Ximenia americana L.*	Fruit
6	*Capparis fascicularis DC.*	Bark

4.8.3 Nutraceutical values of wild edible plants

Out of the total wild edible plants recorded from the study area, 8(25.80%) species serve the local community both as sources of food and as traditional medicine. These Nutraceutical plants are used to treat 7 different human diseases (Table 9).

Table 9: List of wild edible plants with Nutraceutical values

No.	Scientific name	Disease treated
1	*Ficus vasta Forssk.*	Hemorrhoids
2	*Carissa spairanum L. (C. edulis)*	Swollen leg
3	*Cordia africana Lam*	Spider disease
4	*Rumex nervosus Vahl.*	Liver
5	*Rytigynia neglecta (Hiern) Robyns*	Hemorrhoids
6	*Senna petersiana*	Elephantiasis
7	*Dioscorea bulbifera*	Kidney
8	*Ximenia americana L.*	Dry wound

4.8.4 Culture and ritual plants

Some wild edible plant species have culture and ritual values. They have been given by the local community special attention attached to cultural beliefs, religious attributes or socially recognized merits. Among the total wild edible plant species recorded from the study area about 3(9.67%) were used as culture and ceremonial plants. These plant species were *Phoenix reclinata Jacq. , Cyperus usitatus Burch* and *Ficus sycomorus L.*

4.9 Group of Community use wild Edible Plants

In the past women and children were had the responsibilities of collecting, preparing and serving the family food as well as wild food plants. Key informants' responses indicated that, in the present day, children and youngsters were observed in collecting wild food plants. Similarly, these groups of community comprise high proportion in consuming, managing and selling wild edible plants to maximize household income more frequently in compared to other age groups of communities. These of group communities were able to tell full information about the wild edible plants found in the study area. Most of the time women concentrate on the preparing of the collected plants for home consumption.

4.10 Use diversity of wild edible plants

Among the 31 documented wild edible plant species in the study area, 26 plant species (83.8%) were reported to have multipurpose roles while 5 (16.20%) of them have only food role in the area (table 8). This finding shows that the local people harvest the wild edible plants of the area mostly for construction, firewood, and production of house hold

equipment. The utilization of these plants for fire, construction and equipment is linked with the daily life activities of the community.

Table 10: Use diversity of wild edible plants in the study area.

Uses of wild edible plants	Number of species	Percent (%)
Food and firewood/charcoal	6	19.35
Food and construction	4	12.90
Food and medicinal	5	16.12
Food and agricultural instruments	2	6.45
Food, cultural and ritual	3	9.67
Food and farm/house fence	2	6.45
Food and above two functions	4	12.90
Only food role	5	16.12

4.11 Threats to wild edible plants

The ethno-ecological knowledge on threats to WEPs was assessed. WEPs of the study area are threatened due to various anthropogenic and natural causes like other plant species. Accordingly, this survey revealed, many threats facing wild edible plants of the study area in their habitat.

To understand local people's perception on the factors more threatening WEP species eight factors were identified through key informants by priority ranking. These activities were; agricultural land expansion, construction tools, commercial value, fuel wood collection, over grazing, over harvesting, habitat loss and fragmentation and uncontrolled fire setting.

The residual effect of the reduced attention given to wild edible plants means that they are over-harvested for fuel wood, construction material, medicine and other minor uses and this could lead to species rarity and habitat modification.

Table 11: Factors threats to wild edible plants of the study area
Their degree of destructiveness (1= least destructive and 8= most destructive).

Factors for threats	Respondents										Total	Rank
	R1	R2	R3	R4	R5	R6	R7	R8	R9	R10		
Construction tools	7	8	6	8	7	7	8	6	8	7	72	2nd

Commercial value	5	6	7	5	5	5	6	7	4	6	56	3rd
Agricultural land expansion	8	7	8	7	8	8	7	8	7	8	78	1st
Fuel wood	6	5	4	6	4	6	4	5	6	4	50	4th
Over grazing	4	3	5	4	6	4	5	4	5	5	45	5th
Over harvesting	2	4	2	3	1	2	2	3	3	2	24	6th
Habitat loss and fragmentation	1	2	1	2	3	1	3	1	1	1	16	8th
Uncontrolled fire setting	3	1	3	1	2	3	1	2	2	3	21	7th

The result indicated that these plants were exploited more for their non-food uses than for reported food values. Among these factors Agricultural land expansion is the most destructive. Overharvesting of multipurpose wild edible plant species for fuel wood, medicine, fencing, construction, and forage purposes were found the responsible factors aggravating depletion of the species in the area.

4.12 Conservation and management of wild edible plants

Local communities of the study area have numerous indigenous management strategies to conserve plants around their environment. Due to their diverse uses, wild edible plants are left to widely grow in farmlands, farm boundaries and watershed areas. Others frequently appear around homesteads as live fence, shade and along roadsides and degraded areas.

Destroying of valuable shrubs and trees is forbidden by the norms of community. Although, when they cut the branches of the trees in their farmland, they deprive the tip of that tree for continuation of that plant. Besides, personal observation and communication revealed that children and livestock herders bring the seeds after consuming the fruits back to homes and cultivate them around homesteads and fence the seedlings saved from livestock foraging. This shows conservation and domestication of wild edible plants.

Similarly, shrub and tree fodders for livestock feed during dry seasons and drought are lopped or leaves, seeds and pods are shaken down using a sort of sticks instead of cutting down the plants. These are sustainable modes of resource use that need to be encouraged and applied by blending them with standard modern management practices.

5. Discussion

In the present study, relatively high number of wild edible plants was reported as the study area. Total of 31 wild edible plant species distributed among 24 genera and 22 families identified by informants were identified and documented. This may middle number when compared with study in other parts of the Country like (Mersha *et al.*, 2016) who documented 46 species belongs to in 37 genera and 29 families. The possible explanation for these differences could be the differences of local traditions and customs of using these plants.

With respect to the diversity of the species of wild edible plant species gathered from the study area, family Myrtaceae had the highest proportion comprise of (12.9%) species followed by Moraceae and Acantaceae families which contributed three species each. While, Appocynaceae, Capparaceae, Tiliaceae and Rosaceae families were consist of 2 species each and the other the rest 13 families consist only 1 species each. This is due to the species of Myrtaceae family mostly found around the farmland and fruits of the family plant species were attractive and found mostly around farmland. The study in contrary with (Ermias *et al.*, 2011) Fabaceae could be attributed to the highest number of species.

Among the recorded growth forms of wild edible plant species in this study, trees were most dominant of the other. The reason why is, the season of collection of data. i.e. most climbers and herbs disappeared during dry season and emerged during rainy season around the end of spring season and in summer season). This makes the study similar with the study of (Tigist, 2006) around 'Dheeraa' Town, Arsi, Ethiopia and dissimilar with study of (Tinsae, 2013 and Dessalegn, 2017) that stated, the shrubs were the highest life forms.

Regarding to the plant pars used, the result of the study showed, fruits are the most frequently used. What makes this is; fruits are the plant part easily available to use, especially during emergency. This makes this study similar with (Mersha *et al.*, 2016) in Burji District, Zone of SNNP Region, Ethiopia.

The reason why children and youngsters were high proportion in collecting process is may be due to; occupation, place of work, interaction existing between individuals and other, which influence plant experience and knowledge both in age and gender among individuals. This alike the study with the study of Dandena (2010) stated collection of wild edible plants is mainly done by children and livestock herders, youngsters and the poorest families.

As the result of the shows, the wild edible plants mostly consumed raw, which alike the study with Getu (2017) in Amaro District of SNNP Region and Gelana District of Oromia Region, Southern Ethiopia and Mersha *et al.* (2016) in Burji District, Zone of SNNP Region, Ethiopia.

Based on the preference ranking key informants were asked to rank 6 wild edible plant species according to their personal preference based on their frequently usage and taste qualities. Then the scores given to each species were added and the highest score was ranked to be first. Accordingly, *Sysygium guineense* was ranked first which dissimilar with the study of (Tinsae, 2013) *Balanites aegyptiaca* attained the highest total score and ranked first.

Among top five wild edible plant species identified by the informants in pair wise comparison based on their usage for food regularly, *Dioscorea bulbifera* is favoured much over other plant species cited in the study area. This dissimilar the study with the study of (Zemede and Mesfin, 2001) *Tamarindus indica* was reported the first ranked as compared to other species of WEPs of the study.

Most of the wild edible plants recorded from the study area used as supplementary foods sources and were used for food during food scarcity period and when there is failure in harvest of the cultivated food crops because of drought, hence play a role in combating food insecurity. The general public consumes wild edibles as snacks, supplement or refreshments. Therefore, they occasionally consider the wild edible plants as famine foods or foods for children.

As the result from respondents obtained shows, around 83.87% of them used as supplementary food and the rest were used as food regularly or as meal. These Wild edible plants play a vital role in supplementing food diversification and livelihood maintenance. The result is consistent with study of (Zewdie, 2017) in Sheka Zone, SNNP regional state, Ethiopia reported that wild edible plants help to prevent starvation and sustain life during drought season and social unrest.

About 6 (19.35 %) of the total species collected from the study area were reportedly great commercial value in the local market of the study area and serve to generate household income to the poor households. Among these *Dioscorea bulbifera* is the highest commercial value. This makes the study similar with the study of (Demel *et al.,* 2010) that state edible

eild plants in Ethiopia. The study disagree with the study of (Zemede and Mesfin, 2001) stated that, *Tamarindus indica* was one of the wild edible plants to have good local market demand.

According to direct matrix ranking six wild edible plant species based on their general 6 use values showed, wild edible plants of the study area were used for other multi-purpose values in addition to food purpose. These were medicinal, forage, food, firewood, construction, charcoal, fencing, and furniture making, which makes the study look like with the study of (Dessalegn, 2017) in Kamash Woreda, Benishangul Gumuz Regional State, Ethiopia.

Regarding the knowledge associated with wild edible plants, the younger people could tell the uses of plants as food than for other uses. Thus, more ethnobotanical data about the WEPs were obtained from youngsters male. Staying longer time with the plants might have given them enough time to taste the plants and become familiar to them. Consequently, they can identify, tell the names, flavour and compare their sweetness other features. Similar study was obtained from other parts of the country by (Tigist, 2006).

To conserve plants around their environment local communities of the study area have numerous indigenous management strategies. They use conservation strategies non-cultivated food plants in their natural habitat and bringing around their home. This makes same the study similar with study of (Teklehaymanot and Giday, 2010) in Lower Omo River valley, Debub Omo Zone, SNNPR, Ethiopia.

The main factors that threatened to WEPs of the study area were agricultural land expansion, construction tools, commercial value, fuel wood collection, over grazing, over harvesting, habitat loss and fragmentation and uncontrolled fire setting. This makes the study similar with (Tinsae, 2013) on Awash National Park, Ethiopia.

6. Conclusion and Recommendations

6.1 Conclusion

The local people of the study area use a large number of food plant species and exploration and documentation of these wild food plants sources and the traditional knowledge of the study area become very necessary. The result of the study revealed that considerable numbers of wild edible plant species that are suitable for human consumption are available in the study area. These were the resources of livelihoods, supplementing the staple food to ensuring food security and sustained income for the rural community of the study area. About 31 WEPs have been investigated during the present study.

The traditional knowledge (TK) of using these plants is still being transferred from generation to generation; although knowledge about the habitat distribution, edibility, harvesting and uses of most wild edible plant species is still preserved among the study area communities.

6.2 Recommendations

- The ethnobotanical knowledge of local people of the study area on WEPs should be encouraged to be transferred from generation to generation.
- Wild plants of the study area need serious conservation and endangered WEP species should have to be protected by establishing public awareness that encourage protection and maintenance of the plants.
- Wild edible plant species should be domesticated and integrated into home garden in order to better ensure food security, dietary diversification and maximise household income.
- Promoting their potential uses and initiating their domestication and cultivation, studying the nutritional values, marketing and value addition within the communities through cultural transformation and legal is very crucial.
- The way and place of these plants marketed should be modified and needs adjustment.
- Further research is needed to assess further indigenous ethnobotanical knowledge of the local people of the study area, further WEP species, their nutritional value and economic as well as ecological contributions.

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Appendix I: Structured and semi-structured interview

JIMMA UNIVERSITY

COLLEGE OF NATURAL SCIENCE, DEPARTMENT OF BIOLOGY

POST GRADUATE PROGRAM IN BOTANICAL SCIENCE

Structured and semi-structured interview for collecting ethnobotanical data of wild edible plants

Dear respondent, this is a questionnaire is prepared by post graduate of Botanical science student for currently conducting a research on the title: "**Ethnobotanical Study of Wild Edible Plants in Dabo Hana District**". I kindly request you to spare some of your precious time for filling this questionnaire. In line with this, I confirm that all data will be used for academic purpose and will be analysed anonymously and you are not exposed to any harm because of the information you give.

- Please don't write your name
- Put a tick (√ **or** X) mark against your choice for items with alternative;
- Please write your answer briefly for open ended questions

Part I; Socio-Demographic Information of Respondents

1. Date _____ Month _____ Year _____
2. Respondent's sex: Male □ Female □
3. Age _____
4. Marital status a. Single □ b. Married □ c. Divorced □ d. Windowed □
5. Educational status a. Illiterate □ b. Primary School (1-8) □ c. Secondary School (9- 12) □ d. Certificate /or diploma □ e. BA/BSC and above □

Part II; Ethnobotanical information on wild edible plants

1. Do you know any wild plant in your area?
   a. Yes □ b. No □
2. Are there other uses of wild edible plants other than food value?
   a. Yes □ b. No □
3. If your answer on number 3 is "Yes", what are these multipurpose uses of wild edible plants common to you? _____

4. Which plant part of wild edible plants **do you use**?
   a. Stem □ b. leaf □ c. root □ d. seeds □ e. fruits □ f. other
5. Are there wild edible plants used for food sold in the local markets in this area?
   a. Yes □ b. No □
6. Which groups of the community commonly collect and use wild edibles?
   a. Children □ b. adult □ c. older (men/women) □
7. What does the time of wild edible plants are commonly practiced by local communities? a. during normal times □ b. food shortage □ c. famine/prolonged drought □ d. social unrest □
8. Do the local people care for wild edible plants during collecting them from the field?
   a. Yes □ b. No □ c. somewhat □
9. Are there any indigenous management strategies commonly practiced by the local communities to conserve wild edible plants in the study area? 1. Yes, 2. No
10. If your answer is "Yes" to Question Number 10, describe those strategies commonly practiced by the local communities. _ _____
11. Are there threats to wild food plants? a. Yes □ b. No □
12. If your answer on question No.12 is Yes, list these threats on the given space;

    _____

    ____ _____.

Appendix II: Focus group discussion

JIMMA UNIVERSITY

COLLEGE OF NATURAL SCIENCE

DEPARTMENT OF BIOLOGY

POST GRADUATE PROGRAM IN BOTANICAL SCIENCE

Interview for focus group

1. Are there wild edible plants that are traditionally used by the local people in your area? If yes' list them _____
2. What are the most popular wild edible plants commonly used by local communities? List down in their respective orders.
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.
6. What does the mode consumption of them? E.g., raw, cooked/roasted, raw/cooked, any ingredients added (e.g., spicing), etc.
7. What do you know other multi-purposes of wild edible plants out of food value?
8. Are there wild edible plants sold in the local markets in this area? List them _____
9. Do the local communities try to conservation wild edible plants of their area? If yes, by what methods? List _____

Appendix III Lists of wild edible plants

Lists of wild edible plant species of the study area with their local name and habits

Code	Scientific name	Family	Local name (Afan Oromo)	Habit
GI005	*Acanthus Eminence*	Acanthaceae	Sokorruu	Shrub
GI027	*Adansonia dijitata l.*	Bombacaceae	xuphannoo	Tree
GI023	*Capparis fascicularis DC.*	Capparaceae	Qawisa	Tree
GI010	*Capparis tomentosa Lam.*	Capparaceae	Arangamaa	Shrub
GI03	*Carissa spairanum L. (C. edulis)*	Appocynaceae	Agamsa	Shrub
GI016	*Cissus rotundifolia (Forssk.) Vahl*	Vitaceae	Burii	Climber
GI025	*Cordia africana Lam*	Boraginaceae	Waddeessa	Tree
GI004	*Cyperus usitatus Burch.*	Cyperaceae	Qunnii	Herb
GI024	*Dioscorea bulbifera*	Dioscoreaceae	Kottee harree	Climber
GI007	*Ficus sycomorus L.*	Moraceae	Odaa	Tree
GI012	*Ficus sur Forssk.*	Moraceae	Harbuu	Tree
GI029	*Ficus vasta Forssk.*	Moraceae	Qilxuu	Tree
GI018	*Grewia bicolor Juss.*	Tiliaceae	Harooressa	Tree
GI020	*Grewia ferruginea Hochst. ex A. Rich*	Tiliaceae	Dhoqonuu	shrub
GI031	*Hygrophila auriculata*	Acanthaceae	Mata bokkee	Herb
GI030	*Justicia schimperiana (Hochst. ex Nees) T. Anders.*	Acanthaceae	Dhummuugaa	Shrub
GI017	*Landolphia buchananii (Hall.f.) Stapf*	Apocynaceae	Geebboo	Climber
GI022	*Lantana camara L.*	Verbenaceae	Midhaan dubaraa	Shrub
GI021	*Mimusops kumel Bruce ex DC.*	Sapotaceae	Qolaatii	Tree
GI019	*Oncoba spinosa Forssk.*	Flacourtiaceae	Akuukkuu	Tree
GI026	*Psidum gusigava L.*	Myrtaceae	Zeytuna	Tree
GI008	*Phoenix reclinata Jacq.*	Arecaceae	Meexxii	Shrub
GI028	*Physalis peruviana L.*	solanaceae	Hawuxii	Herb
GI001	*Rubus apetalus Poir.*	Rosaceae	Goraa	Shrub
GI014	*Rumex nervosus Vahl.*	Polygonaceae	Dhangaggoo	Shrub

GI015	*Rytigynia neglecta (Hiern) Robyns*	Rubiaceae	Mixoo	Tree
GI002	*Senna petersiana*	Cyathaceae	Raamsoo	Shrub
GI011	*Sysygium guineense (Willd.) DC.*	Myrtaceae	Baddeessaa	Tree
GI009	*Sysygium oleosum*	Myrtaceae	Goosuu	Tree
GI013	*Sysygium zeylanicum*	Myrtaceae	Daalotee	Tree
GI006	*Ximenia americana L.*	Olacaceae	Hudhaa	Tree

Appendix IV: Families of wild edible plant species

Families of wild edible plant species of the study area with their parts used for food and Mode of consumption.

No.	Family	Scientific name	Part used	Mode of consumption
1	Acanthaceae	*Acanthus Eminence*	Nectar	Raw
		Hygrophila auriculata	Nectar	Raw
		Justicia schimperiana (Hochst. ex Nees) T. Anders.	Nectar	Raw
2	Capparidaceae	*Capparis fascicularis DC.*	Bark	Cooked
		Capparis tomentosa Lam.	Fruit	Raw
3	Appocynaceae	*Carissa spairanum L. (C. edulis)*	Fruit	Raw
		Landolphia buchananii (Hall.f.) Stapf	Fruit	Raw
4	Vitaceae	*Cissus rotundifolia (Forssk.) Vahl*	Tuber	Cooked
5	Boraginaceae	*Cordia africana Lam*	Fruit	Raw
6	Cyperaceae	*Cyperus usitatus Burch.*	Bulb	Cooked
7	Dioscoreaceae	*Dioscorea bulbifera*	Tuber and fruit	Cooked
8	Moraceae	*Ficus sycomorus L.*	Fruit	Raw
		Ficus sur Forssk.	Fruit	Raw
		Ficus vasta Forssk.	Fruit	Raw
9	Tiliaceae	*Grewia bicolor Juss.*	Fruit	Raw
		Grewia ferruginea Hochst. ex A. Rich	Fruit	Raw
10	Verbenaceae	*Lantana camara L.*	Fruit	Raw
11	Sapotaceae	*Mimusops kumel Bruce ex DC.*	Fruit	Raw
12	Flacourtiaceae	*Oncoba spinosa Forssk.*	Fruit	Raw
13	Bombaaceae	*Adansonia dijitata l.*	Fruit	Raw
14	Arecaceae	*Phoenix reclinata Jacq.*	Fruit	Raw
15	Solanaceae	*Physalis peruviana L.*	Fruit	Raw
16	Rosaceae	*Rubus apetalus Poir.*	Fruit	Raw
		Rubus idaeus "Fall Gold" ??	Fruit	Raw
17	Polygonaceae	*Rumex nervosus Vahl.*	young stem	Raw
18	Rubiaceae	*Rytigynia neglecta (Hiern) Robyns*	Fruit	Raw

19	Cyathaceae	*Senna petersiana*	Fruit	Raw
20	Myrtaceae	*Sysygium guineense (Willd.) DC.*	Fruit	Raw
		Sysygium oleosum	Fruit	Raw
		Sysygium zeylanicum	Fruit	Raw
		Psidum gusigava L.	Fruit	Raw
21	Olacaceae	*Ximenia americana L.*	Fruit	Raw
22	Bombaceae	*Adansonia dijitata l.*	Fruit	Raw

Appendix V: Photographs

A) During collection of data

B) Pressed plant specimen

C) Labbelled plant specimens