Jimma University

College of Natural Sciences

Department of Biology

Study on Ethnobotany of Edible Wild Plants in Shabe Sombo District, Jimma Zone, Oromia Regional state, Southwest Ethiopia

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A Thesis Submitted to Department of Biology, College of Natural Sciences, Jimma University for the partial fulfillment of Masters Degree in Botanical Sciences.

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Abstract

The ethnobotanical study of wild edible plants was conducted in Shabe Sombo district. The objective of the study was to assess Ethnobotany of wild edible plants and the associated knowledge of the local people. Four villages were purposively selected for the data collection from study area and 370 Informants were selected randomly from 4909 households by using simple random sampling. The sizes of sample population for each Ganda (the smallest administrative unit) were determined using sample size determination formula of Yamane (1967). Data collection on wild edible plants was conducted from March to April, 2019 with representative households. The collections of wild edible plants data tools were semi-structured interview, focus group discussions and guided field walks with informants. The collected ethnobotanical data was analyzed by using Microsoft Excel spreadsheet, Preference ranking, paired comparison and direct matrix ranking. A total of 38 wild edible plant species belongs to 31 genera and 27 families were identified from the study area. In the study area, the collections of this plant species were dominated mainly by children and women. Regarding the mode of their consumptions, the majorities (86.8%) of WEPs were consumed raw and the others were after cooked. Trees account for 42.1% followed by shrubs (28.9%). Fruits were the most used part of the wild edible plants and followed by seed (10.0%), tuber/root (7.5), leaves (5.0%) and young shoot (5.0%) in the study area. The diversity use values of ten wild edible plant species from the total of WEPs in Shabe Sombo district were recorded. Of these, the average use value for the species was taken, the scores of each species summed up and ranked. According to preference ranking analysis, the fruits of Psidium guajava were the most preferred wild food fruits over the other reported wild edible plants followed by Passiflora edulis, Syzygium guineense and Rubus steudneri. However, WEPs are like other plant species threatened due to various human activities and natural causes. Therefore, the conservation of plant species and assessing as well as preserving indigenous knowledge were the fundamental urgent issues.

Keywords: Shabe Sombo, Ethnobotany, edible wild plant.

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List of Acronyms

NTPPs = Non-Timber Plant Products

SSLAO = Shebe Sombo Land Administration office

SSAO = Shebe Sombo Agricultural Office

WEPs = Wild Edible Plants

SNNPR= South Nation Nationalities and People Region

1. Introduction

1.1 Background of the Study

Plants are important to almost all living organisms on the earth, give protection and nourishment (Cotton, 1996). Humans produce food, medicines and a number of ecosystem services such as air purification, recharge of water bodies, nitrogen fixation, cycling of nutrients as well as many more range of other plant resources from plant biodiversity **(**Khanal, 2006). The interaction between plants and people, with a particular emphasis on the cultures of people is studied under a field of Ethnobotany (Martin, 1995; Balick and Cox, 1996).

Wild edible plants are also widely distributed in the world. However there is scarcity of information concerning their taxonomy, genetic diversity, and uses, among other issues (IBC, 2005**)**. Wild edible plants are used as staple food for many people. The term wild edible plant refers as species that are neither cultivated nor domesticated, but that is available from its wild natural habitat and used as source of food (Beluhan and Ranogajec, 2010). More than 70% of the wild edible plants are consumed during a period of food deficiency and starvation (Tilahun Teklehaymanot and Mirutse Giday, 2010). Similarily, Getachew Addis *et al.* (2005) noted that wild plants in Ethiopia are serving as source of food at a time of food problem.

Different people in many developing countries do not have sufficient food to meet their daily needs and a further more people are deficient in one or more micronutrients. For different purposes many rural communities rely on wild resources including wild edible plants (Kebu Balemie and Fassil Kebebew, 2006). Numerous studies showed that many wild edible plants are nutritionally rich and can provide micronutrients like minerals and vitamins. Nutritional analysis of some wild edible plants shows that in many cases, their nutritional quality is comparable and in some cases even higher than the domesticated varieties. There is good evidence that indicates the importance of wild edible plants in terms of the general food basket. Since wild edible plants are freely available within natural habitats, indigenous people have knowledge of how to gather and prepare the foods (Kebu Balemie and Fassil Kebebew, 2006).

More than 7,000 species of wild edible plants have been recorded in human history. In different country sides such as China, India, Thailand and Bangladesh hundreds of wild edible plants are still consumed along with non-cultivated species (Mazhar *et al.*, 2007). Leaves, stems, fruits, flowers, tubers, barks, seeds, roots and lots of wild edible part of plants are still consumed for their dietary value in many communities of the world. Some of these wild edible plants are used as primary food sources while others are used as secondary condiments in dishes prepared from domesticated cultivars (Ermias Lulekal *et al*., 2011). The work of Becker (1983), reported the presence of different vitamins in wild edible plants of Senegal.

Ethiopia is a country with varied topography and a wide spectrum of habitats presenting a large number of endemic plants and animals. In most parts of Ethiopia, wild edibles form integral parts of the feeding habits of many communities (Kebu Balemie and Fassil Kibebew, 2006). The Ethiopian vegetation formations, particularly the forest resources are under risk because of different factors, especially for the reason of farms and grazing (Getu Alemayehu, 2017). Therefore, conservation is the target issue to transfer the indigenous knowledge of communities to the next generation as it is alive. There is a widespread factors influence the knowledge of wild food plants especially among young people. The conservation of plant species and documenting as well as preserving indigenous knowledge are the fundamental urgent issues. For this reason, this study was initiated to assess ethnobotanical knowledge of wild edible plants in Shabe Sombo districts and implications on conservation, management and sustainable use for their better utilization.

1.2. Statement of the problem

The plants and their products used as a source of food, wood, medicine, oil, fodder, aroma, ornamental and other uses had been originated during the beginning of human civilization (Khanal, 2006). According to Martin (1995), ethnobotanical data are basic for conservation and sustainable development of plants. Ethnobotanical data are also, useful to broaden our plant use knowledge (Ensermu Kelbessa *et al*., 1992). Numerous studies showed that many wild edible plants play great role in supporting the local community during the problem of food shortage (Kebu Balemie and Fassil Kebebew, 2006; Getachew Addis *et al.*, 2005; Loghurst, 1986; Ogle and Grivetti, 1985 and Atinafu Kebede *et al*., 2017). But, currently many of the physical and species composition of natural vegetation of the area is decreasing and losing due to different human activities and natural factors. So far, there has not been any research work on the availability of wild edible plants in Shabe Sombo district. Therefore, this study has been designed to fulfill the knowledge gap on the wild edible plants of the district.

1.3. Research Questions

1) What are the wild edible plants used by people in Shabe Sombo district?
2) Who are the major gatherers of these plant species?
3) Which parts of the wild edible plants are consumed in the area?
4) How the knowledge of WEPs are transferred and practiced?
5) What are the threats of wild edible plants in the study area?
6) How do the local people manage and conserve these wild food plant species through their traditional practices?

1.4. Objective of the study

1.4.1. General Objective

The general objective of this study was to assess wild edible plants, associated indigenous knowledge and the existing threats to wild edible plants in Shabe Sombo district.

1.4.2. Specific Objectives

The specific objectives of the study were the following.

1. Assess wild edible plant species in Shabe Sombo district.
2. Identify the parts of wild edible plants used.
3. Assess multipurpose of wild edible plants.
4. Assess threats on the wild edible plant species.

1.5. Significance of the study

Different researches are being carried out in many countries with the aim of raising the use of wild edible plants to cover the prevalence of food crisis during a time of staple food decline. Therefore, significance of the study was to assess wild edible plants associated with the indigenous knowledge of local people on these plant species and recommend the possible management practices for the conservation of wild edible plants in Shabe Sombo district.

2. Review of Related Literature

2.1. Ethiopian Vegetation

Vegetation is an accumulation of plants growing together in a particular area, or the collective plant species of an area (Jennings *et al.*, 2003). Ethiopia is a country with diversity of vegetation. Plants are useful for human beings in various ways. They uses as sources of food, export products for country, for building, for timber production, for medicine, release oxygen into atmosphere and habitat for many types of living organisms (Mosisa Wakshum, 2007). The factors that can causes effect on Vegetation are climatic condition, geology, edaphic factors and biotic factors, including interference by humans during ecological succession. The dynamic condition is occurred in vegetation, which it is constantly changing (Getu Alemayehu, 2017).

The most important climatic issues of agricultural production in Ethiopia are temperature and rainfall. According to Alemayehu Mengistu (2003), altitude is a factor that determines the distribution of climatic factors and suitability of land that influence the crops to be grown, rate of crop growth, natural vegetation types and their species diversity. Ethiopia is enriched with wide range of vegetation formations or types ranging from afro alpine to desert vegetation. Different researchers have studied and described the vegetation types of the country at different times. There are twelve vegetation types in Ethiopia, these major vegetation types include; Desert and Semi desert scrubland Forest; *Acacia – Commiphora* woodland and bush land; Wooded grassland of the Western Gambela region; *Combretum - Terminalia* woodland and wooded grassland; Dry Evergreen Afromontane forest and grassland complex; Moist Evergreen Afromontane forest and bush land; Transitional rain forest; Ericaceous belt; Afro-alpine belt; Riverine vegetation; Fresh - water lakes vegetation and Salt Lakes vegetation (Friis *et al.*, 2010).

2.2. Uses and resources of forest

The wide ranges of ecological, economical, social and cultural consideration processes determine the products gained from forests. There are numerous ranges of services that forests provide in addition to their values of basic goods. These major services of forests include: regulation of water regimes, modulating climate, maintenance of biodiversity, cultural uses and as well as forests play a crucial role in soil and water conservation, watershed protection, nutrient recycling, nitrogen fixation, wildlife habitat, gene conservation, regulating the concentration of

gases in the air and sequestering carbon dioxide from the atmosphere. Various findings have also indicated the importance of forests as it is source of non-timber plant products (NTPPs) (Getu Alemayehu, 2017). The raw materials for wood-based energy, home construction, wood-based industries, farm implements, and fuel wood opportunities are the results of forests and wood land in Ethiopia. NTPPs contain coffee, spices, honey, medicine, animal fodder, and WEPs (Getachew Desalegn and Wubalem Tadesse, 2004). According to Zemede Asfaw and Mesfin Tadesse (2001), about 5% of the total plants in the world are used as source of food. About 20 to 30 crops are providing the world's nutritional roles and many of plants with utilization of nutritional values exist in the wild.

2.3. The Importance and Background of Ethnobotany

Ethnobotany is a branch of natural science that needs the involvement of various aspects such as anthropology, archaeology, botany, ecology, systematic, religious studies, forestry, agro-forestry, economics and medicine, cultural and several other disciplines. Ethnobotany is defined as the study of the relationships between plants and people (Balick and Cox, 1996). Martin (1995) recognized ethnobotany as the study of how local people classify, manage and use plants available in their environments. Ethnobotanical study seems to have started with Christopher Columbus in 1492, at a time when he brought tobacco, maize, spices and other useful plants from Cuba to Europe (Cotton, 1996) and when other immigrants from the new world documented food, medicine and other useful plants of the Aztec, Maya and Inca peoples. Ethnobotanical investigation documents the knowledge on cultural interaction of people with plants. It also tries to find out how local people have traditionally used plants for various purposes and how they used plants into their cultural and religions (Endalew Amenu, 2007). Ethnobotany is a key subject for conservation and sustainable development (Martin, 1995). Peoples of all cultures always depend on plants for their basic needs like food, shelter, medicines and etc. Therefore, an ultimate goal of ethnobotanical study is to ensure that local natural history becomes a living tradition in communities (Getu Alemayehu, 2017).

2.4. Wild Edible plant resources

The various numbers of people in developing countries do not have daily sufficient food requirements and many of them are deficient in micronutrients. For many reasons rural communities based on wild resources including WEPs to meet their food needs in periods of

food shortage. Globally, many People use various types of food depending on their culture. High species of wild fruits, leaves, seeds, roots and tubers are consumed as food plant part in worldwide. Wild edible plants refer as species that are neither cultivated nor domesticated, but that are available from their wild natural habitat and used as sources of food and it provide staple food for indigenous people (Beluhan and Ranogajec, 2010)

The majority (70%) of the wild edible plants were consumed during a period of food deficiency and starvation, when the saved cultivated food crops decreases (Tilahun Teklehaymanot and Mirutse Giday, 2010). It is estimated that, about 75,000 to 80,000 species are believed to be edible throughout the world (Getu Alemayehu, 2017). According to different scholars, wild plants in Ethiopia are serving as source of food in a time of food problem (Getachew Addis *et al*., 2005). Wild and semi-WEPs highly promote to family food security and also, used as a means of survival during season of drought, famine and risks (Mekuanent Tebkew, 2015). They could be contributing nutritional needs due to their better nutrition and they offer an alternative source of cash income for poor communities (Kebu Balemie and Fassil Kebebew, 2006).

Many of the researchers showed that wild edible plants are essential components of many Africans diets, especially in periods of seasonal deficiency of foods. Some poor households depend on wild fruits as an opportunity to cultivated food for all dry season's meals (Atinafu Kebede *et al*., 2017). Similarly, in Northern Nigeria, leafy vegetables and other bush foods are collected as daily supplements to relishes and soups (Loghurst, 1986). In Swaziland, wild plants are still having a crucial role and contribute a greater share to the annual diet than domesticated crops (Ogle and Grivetti, 1985).

Ethiopia is a country with varied topography and a wide spectrum of habitats presenting a large number of endemic plants and animals. There are about 243 families of vascular plants in the Flora area, of those 175 are available in both Ethiopia and Eritrea, 63 only in Ethiopia and five only in Eritrea. In this way, the Ethiopian Flora includes about 238 vascular plant families while that of Eritrea has 180 families. From about Flora area of 1,592 genera, 842 are found in both countries while, 697 genera in Ethiopia and 53 genera are found only in Eritrea. Hence, there are 1,539 genera in Ethiopia and 895 in Eritrea. From these, 6,027 species (including subspecies)

found in Flora area, 1,882 are common to both countries while 3, 875 have been recorded from Ethiopia and 270 from Eritrea only. Generally, there are 5,757species (including subspecies) in Ethiopia and about 2,152 species (including subspecies) in Eritrea (Ensermu Kelbessa and Sebsebe Demissew, 2014).

Many of forests, grasslands, riverine environments and wetlands are habitat to various wild edible plants in the country. In Ethiopia, there are lots of food materials that are obtained from plants. Around 8% of the higher plant species in the country are serving as food materials and 25% of these are cultivated and there are also many wild edible plants that produce quantities of food (Atinafu Kebede *et al*., 2017). There is essential evidence that indicates the importance of wild edibles in terms of the global food basket. Many of the people in the world use wild foods (mostly from plants) on a daily need. Since wild edible plants are freely accessible within natural habitats, indigenous people have knowledge of how to gather and prepare the foods (Atinafu Kebede *et al*., 2017).

Numerous studies showed that as many wild food plants with high nutritional content such as protein, carbohydrate, mineral, vitamin B2, and vitamin C, which used as in the human diet (Getnet Chekole, 2011; Kebu Balemie and Fassil Kebebew, 2006). Nutritional analysis of some wild edible plants indicates that in many cases, the nutritional quality of wild edible plant is comparable and in some cases even higher than domesticated varieties. The current studies noted that about 8% of the nearly 7000 higher plants of Ethiopia serve as a food supplements and of these, 203 wild and semi-wild plant species are documented (Kebu Balemie and Fassil Kebebew, 2006).

Today various wild species are believed to be edible and undocumented. Recently, some ethnobotanical studies have undertaken in some parts of the country. However, the majority of these studies have focused medicinal species and little attitudes have been given to wild edible plants. Over 300 million people obtain a substantial part of their livelihood in the form of Non-Timber Forest Products from wild forests (Belcher *et al*., 2005). Over 50% of the world daily requirements of proteins and calories are promoted from only three crops (wheat, maize and rice). The reliance of a few domesticated species limits dietetic diversity and leads to over

dependence on limited resources. In countries such as China, India, Thailand and Bangladesh, hundreds of WEPs are still consumed along with non-cultivated species. In addition to their contribution in food security, many wild edible plants such as *Adansonia digitata* L. (Malvaceae), *Moringa stenoptela* (Bak. f.) Cufod. (Moringaceae), *Syzygium guineense*(Wild.) DC. (Myrtaceae) and *Ximenia americana* L. (Oleaceae) are acknowledged for their medicinal, cultural, forage and economic values (Ermias Lulekal *et al.*, 2011).

2.5. Nutritional value of Wild edible plants

Different plant parts: leaves, stems, fruits, flowers, tubers, barks, seeds and roots of lots of wild edibles are still consumed for their dietary value in many communities of the world. Some of these wild edible plants are used as primary food sources while others are used as secondary condiments in dishes prepared from domesticated cultivars. These plants play an important role as a source of energy and micronutrients (Ermias Lulekal *et al.,* 2011). Becker (1983) reported the presence of vitamins A, B_2, and C in wild edible plants of Senegal. Research on six wild edible plants from Spain also confirmed the occurrence of lipids, fatty acids and carotenes in the leaves of these species (Guill-Guerrero and Rodriguez-Garcia, 1999). Protein content in a proportion that is comparable to the amount in domesticated plants was also reported from a nutritional study of wild edible plants in South Africa (Afolayan and Jimoh, 2009). An investigation on the food value of eight wild edibles in Iran and India also showed the presence of sodium, calcium, potassium, iron, zinc, protein, and fat in a ratio comparable to that found in cultivated plant species (Aberoumand, 2009). Many wild leafy vegetables of Poland are also mentioned for their rich source of vitamin C, natural antioxidants, carotenoids and folic acid (Luczaj, 2010). Generally, the information available from the nutritional analysis of wild edible plants shows their potential contribution to dietetic diversity and food security.

2.6. Threats to Ethiopian vegetation

The loss of forest resource is severe in the Ethiopian highlands where most of the large mountain massifs in the heart of the country lie above 1500 m elevation. These highlands cover about 44% of land area and accommodate 88% of the total population because of their agricultural potential and low prevalence of diseases. They also contain about 95% cultivated land and more than 67% of the livestock. The location of these high forests, the concentrate human population and their

different ecology make them disappeared and more susceptible to strong deforestation (Getu Alemayehu, 2017). The main sources of threats to plants are, manmade and nature cause factors. The rapid increase in population: the need for fuel, urbanization, timber production, over harvesting, commercialization, honey cut, degradation, agricultural expansion and habitat destruction are human caused threats to plants. Likewise, natural causes include recurrent drought, bush fire, disease and pest out breaks (Ensermu Kelbessa *et al.,* 1992).

Many wild edible species are endangered due to genetic erosion (IBC, 2005). These phenomena are more prevalent in countries like Ethiopia where high rate of human population growth is concentrated by insufficient documentation and conservation of living organisms that can safeguard promising plant kingdom (Zemede Asfaw and Mesfin Tadesse, 2001). According to Getachew Addis *et al*. (2005), the role of wild edible plants in duration of food shortages and providing food variety, very little emphasis has been given to store and for conservation of these species. The reported anthropogenic pressures in the country have resulted in a loss of many hectares of forest that shelter for WEPs. This loss was also reported to limit benefits gained from the plants and loss of indigenous knowledge associated with these plants. Unsustainable use of knowledge on WEPs has also faced problems because of change in the feeding culture of the people (Getu Alemayehu, 2017).

2.7. Conservation and management of wild food plants in Ethiopia

The major part of plant material important in medicinal and wild edible plant is collected from natural vegetation (Melakeselam Dagnachew, 2001). Conservation is also the target issue to transfer the indigenous knowledge of communities to the next generation as it is alive. Thus, conservation is defined as the sustainable use of biological resources (Zemede Asfaw, 2001). In a broad sense, conservation is achieved through in-situ and ex-situ means. In-situ conservation is conservation of species in their natural habitat (Haile Yineger, 2005). Indigenous people of different localities have developed their own specific knowledge on plant resources, utilities, management and conservation (Cotton, 1996). The systematic application of indigenous knowledge is important for sustainable use of resources and sustainable development (Thomas, 1995).The knowledge about the use of plant is largely oral; however, Ethiopians ancient church

practices have documented some knowledge as inscribed as medico religious written in *Geez* manuscripts of 16th c (Dawit Abebe and Ahadu Ayehu, 1993).

The ultimate goal of such study is to ensure that local natural history becomes a living tradition in communities where it has been transmitted orally for many years. Ethnobotany is a key subject for conservation and sustainable development. Ethnobotanical studies are useful for not only documenting, analyzing and disseminating indigenous knowledge of local people but also it work in the interaction between biodiversity and human society, including how biodiversity is valued in different societies and how it is influenced by human activities (Martin, 1995).

3. Methods and Materials

3.1. Description of the study area

The study was carried out in Shabe Sombo district. Shabe Sombo is one of the districts of Jimma Zone, Oromia Regional State and southwest Ethiopia (Figure 1). It is bordered by Seka Cokorsa and Gera district in the north, Seka Cokorsa in the east, Gojeb River in the south, which eventually drains into Omo Gibe river system supports the growth of vegetation and in the west bordered by Gera district. It is about 405 km from Addis Ababa. A total of Ganda (the smallest administrative Unit) in Shabe Sombo district are twenty two (20 rural and 2 urban) *Ganda*. The elevation ranges from 1200m to 2440m and is characterized by three agro climatic zones highland (15%), middle land (65%) and lowland (20%). The geographical coordinates 7º 17’00’’ to 7º44’00’’N Latitude and 36º17’00’ to 36º52’00’’E Longitude. The annual average temperature of the district is from 19ºc to 23 ºc (SSAO, 2011). The annual rainfall data is moderate and it is favorable to different types of crops and fruits. The area of land under the district is 765,588,906.2 hectares, from these 23546 hectares covered by crop production, 233 hectares for chat, 24425 hectares for coffee, 51 hectares for different fruit and vegetables, 49 hectares used by grazing (SSLAO, 2011). As National census reported (2007), a total population number of the district is 112, 068. Out of these, 56,737 are males and 55,331 are females. As well as 5,265 or 4.7% population are urban.

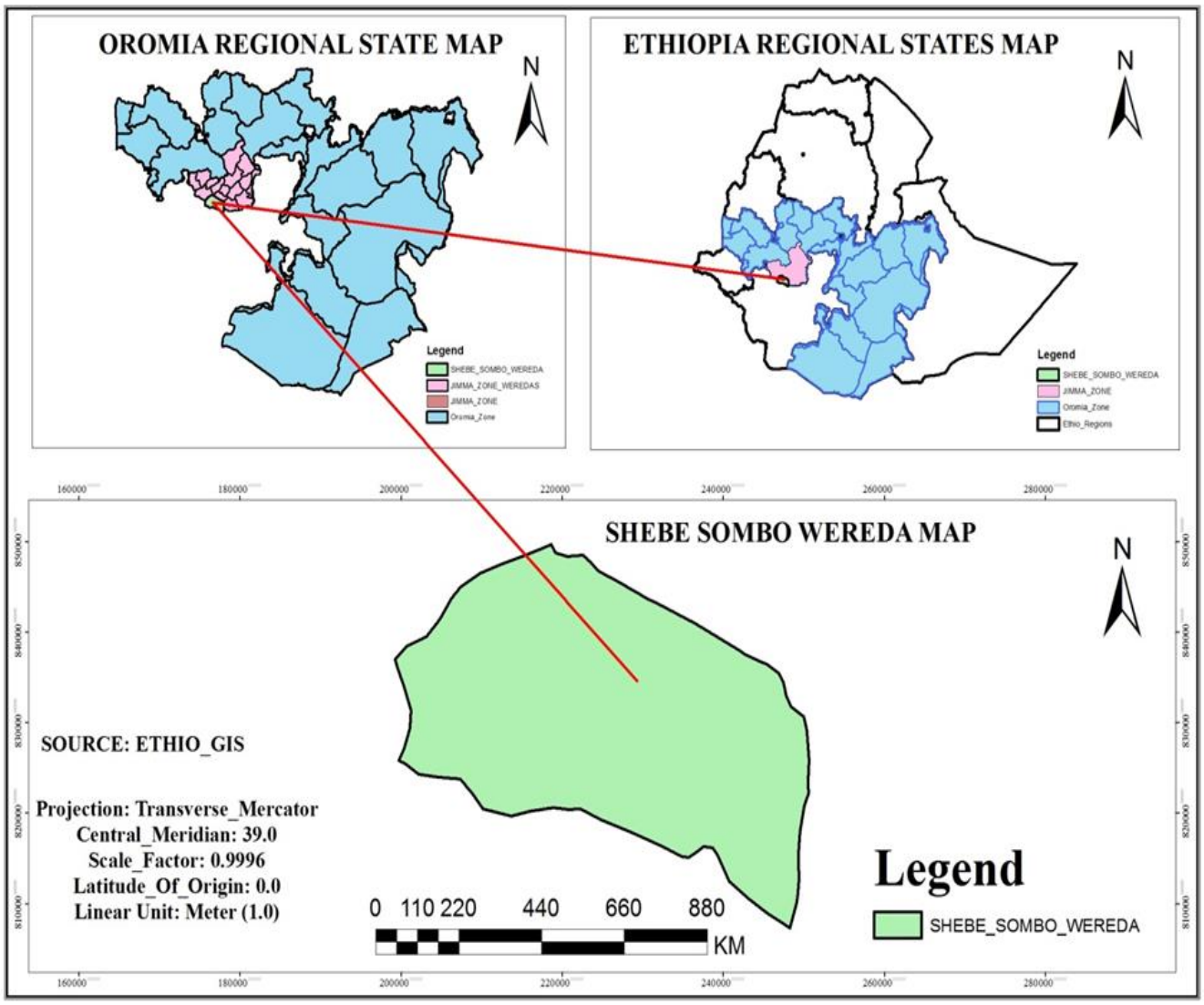

Figure 1**:** Study area map showing Ethiopia, Oromia, Jimma Zone and Shabe Sombo district

3.2. Sample size determination and sampling techniques

A purposive sampling method was employed to select four smallest administrative unit (*Ganda*) based on the coverage of their vegetation. Informants were selected randomly from the village by using simple random sampling. The sample size population of each *Ganda* was based on the number of their households (Table 1) and the following formula (Yamane, 1967) was applied. The individual respondents were selected by using different cards that have number and empty up to fill the required samples. It considered confidence level of 95% and accepting the level of precision (e) of 5%.

$$n = \frac{N}{1 + N(e^2)}$$

Where: n = sample size

N = Population size sample

e = level of precision considered (5%).

For determining the sample size at each *Ganda* (the smallest administrative Unit) level, the following formula was used:

$$ni = Ni \times n/N$$

Where: ni= sample size determined

Ni= number of households in a village

n= sample size and

N= the total number of households selected

Table 1**:** Name of selected the smallest administrative unit (*Ganda*) from the district

No.	Name of Ganda	Households	Sample size	Age		Sex	
				15-30	≥ 30	Male	Female
1	Atiro Gafare	1325	100	30	70	70	30
2	Mirgano Basso	1058	80	16	64	38	42
3	Yanga Dogama	1000	75	22	53	41	34
4	Shabe Dasso	1526	115	25	90	65	50
Total		4909	370	93	277	214	156

3.3. Data collection Method

Data collection on wild edible plant species was carried out from March to April, 2019 with representative heads. Data collecting tools were semi-structured interview, focus group discussions, and guided field walks with informants. Field observations were carried out with local field guide who have the skill of local language. Based on the Ethnobotanical information

obtained from informants, sample specimens were collected during guided field walks with their local names and numbered, pressed, and dried for identification. Identification of specimens was carried out both in the field and in the herbarium. In herbarium identification, I used Flora of Ethiopia and Eritrea and comparing with the already identified specimens in the herbarium. Finally, the identified specimens were stored at Jimma University Herbarium, Ethiopia.

3.4. Data Analysis

Microsoft Excel spreadsheet was employed for organizing some ethnobotanical data. Also, Preference ranking, paired comparison and direct matrix ranking were computed.

3.4.1. Preference ranking

Preference ranking was computed to analyze most preferred wild edible plants, at least in the context of the people who used them during food crisis in the area. The preferences of six wild edible plants were undertaken with ten randomly selected informants to determine their order of cultural importance across a community based on their taste of food parts. The value of each species was summed up and the rank was determined based on the total score.

3.4.2. Paired comparison

This analytical tool was used for evaluating the degree of preferences or levels of importance of certain selected plants (Nemarundwe and Richards, 2002). These were for the most threatened wild food plants according to the report of the informant. A list of the pairs of selected items with all possible combinations were made and sequenced of the pairs and the order within each pair was randomized before every pair is presented to selected informants and their responses recorded, total value summarized and rank was made based on the report of the informants.

3.4.3 Direct matrix ranking

Direct matrix ranking was made based on the use diversities of wild edible plant species for that found in the study area.

4. Results and Discussions

4.1. Characteristics of the Respondents

The 370 respondents were grouped into two age groups; young (15–30) and adult (above 30). From the total, 74.86% of the respondents were above 30 years and 25.13% were between 15 and 30 years. Most of the respondents (54.6%) in the study area were married and 45.4% were unmarried (Table 2).

Table 2**:** Socio demographic characteristics of the informants

Characters	Male	Female	Total	Percentage
Age				
15-30	53	40	93	25.13%
Above 30	161	116	277	74.86%
Total	214	156	370	100%
Marital status				
Married	105	97	202	54.6%
Unmarried	109	59	168	45.4%
Total	214	156	370	100%
Religion				
Muslims	167	132	299	80.8%
Orthodox	31	13	44	11.9%
Protestant	16	11	27	7.3%
Total	214	156	370	100%
Ethnicity				
Oromo	156	113	269	72.7%
Amhara	25	21	46	12.4%
Kafa	20	14	34	9.2%
Yem	13	8	21	5.7%
Total	214	156	370	100%

4.2. Indigenous Knowledge Transfer and Practice

From 370 informants, 280 (75.7%) showed that their knowledge of wild food plants was acquired through observation, and oral history while 90(24.3%) showed that they acquired the knowledge from elders, when they became very old. Moreover, the Ethnobotanical knowledge of wild edible plants was transferred through songs, folklore, and riddles in local languages during the night time especially, when the people are at rest.

4.3. Wild edible plants (WEPs) Taxonomic Diversity

A total of 38 wild edible plant species belonging to 31 genera and 27 families were identified from the study area (Appendix 2). Of these, 30 were exclusive wild foods and 8 were nutraceutical wild plant species. The family Moraceae, Myrtaceae and Rosaceae was represented by the highest number of species with 3 species each. Apocynaceae, Dioscoreaceae, Myrsinaceae, Rutaceae and Solanaceae families had two species each. The rest of 19 families were represented by single species.

4.4. Main gatherers and consumers of wild edible plants

In the study area, as the result from respondents indicated, the gatherers of WEPs were mainly children and women (Table 3). Similarly, as the earlier reports stated in Ethiopia, the gathering of WEPs were mainly by women and children (Tena Regassa, 2016). Elsewhere in Africa especially in Uganda (Agea *et al*., 2011), Tanzania (Vainio-Mattila, 2000) and Sudan (Gullick, 1999) the collection of WEPs were dominated by women and children in the local communities. The study also indicated that WEPs is largely utilized by many of household members. This practice indicates the role of these plant species in the household diet. Moreover, this practice may have far reaching benefit in food crisis and would result in health care as the community is practicing stable food is true elsewhere in Ethiopia.

Table 3**:** The major consumer of Edible wild plants

Collector	Frequencies	Percentage
Women	103	27.8%
Men	72	19.5%
Children	195	52.7%
Total	370	100%

4.5. Wild edible plants and their Habitats in the study area

There are many species of wild edible plants in Shabe Sombo district. However, their distributions, mode of consumption as well as the knowledge of community on WEPs are different. Most of the 38 Wild food plants were occurred in different habitats. Forest is the major home of WEPs followed by woodland, bush land, field margins and roadsides respectively among the others. In the study area, I identified 38 species of edible wild plants that the community uses as food in various ways (Appendix 2).

Ficus sychomorus

Carissa spinarum *Psidium guajava*

Figure 2: Some wild edible fruits of the study area (Photos taken by Kibru Qano)

4.6. Habit of wild edible plants used by the local people

Wild food plants were also diversified in terms of their growth forms (shrubs, trees, herbs and lianas/climbers). The largest numbers of wild edible plants habit (42.1%) were trees and the least (13.2%) were lianas (Table 4).

Table 4**:** Habit of wild edible plants in local area

Habit	Frequencies	Percentage	Rank
Trees	16	42.1%	1
Shrubs	11	28.9%	2
Herbs	6	15.8%	3
Lianas	5	13.2%	4

4.7. WEPs Mode of consumption and their preparations as food

Regarding the mode of consumptions, the majorities (86.8%) were consumed raw and (21.0%) cooked or boiled. Some plant food species are prepared by different methods. This result was also indicates the availability of different mode of consumption in one plant species.

4.8. The edibility Preference ranking of main WEPs in study area

Preference ranking was computed to rank some selected wild edible plants based on the degree of their significance. Following the methods of Martin (1995), each informant was asked to make order and rank. In the study area preferences of wild food plants were identified based on their taste of food parts. For example plants consumed during a season of famine were not consumed during a normal periods. As informants reported, the leaves of *Colocasia esculenta*, *Plectranthus punctatus,* young shoot of *Phoenix reclinata* and others are only consumed during period of food shortage. Moreover, the results of preference ranking in (Table 5) indicated that the fruits of *Psidium guajava* were the most preferred wild food fruits over the other reported wild edible plants and such as *Passiflora edulis, Syzygium guineense* and *Rubus steudneri* are followed respectively. Most of the time the using of wild food plants in a particular area is due to familiarity to the local people. This result agreed with the work of Tariku Berihun and Eyayu Molla (2017).

Table 5: Preference ranking of the most commonly used wild edible plants in study area (R= respondents)

No.	Plant species	R_1	R_2	R_3	R_4	R_5	R_6	R_7	R_8	R_9	R_{10}	Total	Rank
1	*Cordia africana*	3	2	3	2	3	1	1	1	1	2	19	7th
2	*Physalis peruviana*	3	3	3	3	4	4	2	1	1	0	24	6th
3	*Carissa spinarum*	2	3	3	4	5	5	4	4	3	2	35	5th
4	*Rubus steudneri*	4	5	3	3	3	5	4	3	5	5	40	4th
5	*Syzygium guineense Sup.sp afromontanum*	3	4	4	4	5	5	5	4	3	5	42	3rd
6	*Passiflora edulis*	3	4	4	4	4	4	5	5	5	5	43	2nd
7	*Psidium guajava*	4	4	5	5	5	5	5	5	4	5	47	1st

4.9. Wild edible plant parts consumed in the study area

This study also addressed parts of edible plants used by the local community in Shabe Sombo district. Fruits, leaves, Seeds, roots and shoots were the main reported plant parts consumed in the study area. Fruits were the most used (67.5%) part of the wild edibles and the others were followed (Table 6). Many fruits were often consumed raw and some of them were after processed (i.e. after cooked or boiled). The result implies that more than one part of a plant species was consumed by humans. Similar finding was reported by Mersha Ashagre *et al.* (2016), in Burji District, Segan Area Zone of SNNPR of Ethiopia.

Table 6: The most commonly reported edible parts of WEPs in the study area

Plant part	Frequencies	Percentage	Rank
Fruits	27	67.5%	1st
Leaves	2	5.0%	4nd
Seed	4	10.0%	2rd
Tuber/root	3	7.5%	3th
Young shoot	2	5.0%	4th

4.10. Edible wild plants Contribution in food security

Most of the general public consumers use WEPs as snacks, supplementary and refreshment foods. Huge numbers of the indigenous people of an area, occasionally consider the WEPs as famine foods or foods in the condition of starvation even they consider as a food of children. According to the results from study area, some species of wild edible plants were used as a regular food and the others were in supporting the fulfilling of stable food during food crisis. Similar studies were conducted from different parts of the world even from different parts of Ethiopia (Dessalegn Ayele, 2017). WEPs help to prevent starvation and sustain life during drought season and social problems (Dessalegn Ayele, 2017). Around 70% of the WEPs were consumed during a period of food crisis and starvation, when the saved cultivated food crops decreases (Tilahun Teklehaymanot and Mirutse Giday, 2010).

4.11. Traditional Medicinal Uses of Wild Edible Plants

Among the total wild food plants recorded in this study, 8 species (21.0%) serve the local community both as sources of food and nutraceutical plants. In the study area, respondents reported varied plant species including parts like: leaves, fruits, stem barks, root, and seeds were mentioned as useful to treat one or more human health problems and livestock ailments. Moreover, the dried leaves of *Piper capensis* were used by the local community to make the throat clear and increase the audibility of the sound produced, especially for Religious ceremonies and local musicians. The study also showed that the availability of (around 21%) edible wild medicinal plants (Table 7). The majority (62.5%) of medicinal wild edible plants were trees and they used in the treatment of different forms of diseases, in addition to their food values. The result also indicates that people rely more on trees because they are relatively

common in the area compared to other species. This finding agrees with the work of Tariku Berihun and Eyayu Molla (2017).

A  B 

C 

Figure 3: Some medicinal uses of wild edible plants in the area. A*) Piper capensis, B) Embelia schimperiana, C) Dioscorea bulbifera* (photo taken by Kibru Qano)

Table 7**:** Traditional use of medicinal wild edible plants in the study area

R.N0.	Name of plant species	Habit	Ailment treated	Part used
1	*Fagaropsis angolensis*	T	for abdominal pain,	Leaves
2	*Piper capensis*	T	Tonsillitis	Leaves
3	*Mimusops kummel*	T	Abdominal pain	Leaves
4	*Olea welwitschii*	T	Wound	Stem (Body milk)
5	*Peponium vogelii*	L	Gastritis	Fruit
6	*Embelia schimperiana*	Sh	Tape worm	Fruit
7	*Rubus steudneri*	Sh	Tonsillitis	Fruit
8	*Cordia Africana*	T	Constipation	Fruit

4.12. Wild Food Plants and Their Multipurpose Values in the Study Area

Direct matrix ranking was undertaken in order to evaluate multipurpose use of tree species. The result also showed that the local community collects the WEPs for different roles from their natural habitat in addition to nutritional values. The use values of ten multipurpose wild edible plant species from the total of WEPs in Shabe Sombo district were recorded. Of these, the average use value for the species was taken, the scores of each species summed up and ranked. This investigation showed that, *Cordia africana, Syzygium guineense, Fagaropsis angolensis* were ranked 1st, 2nd, 3rd and they were the most preferred wild edible plant species used for various purposes. On the other hand, *Olea welwitschii* was the least ranked species as a multipurpose plant. The results indicated that the local communities collect multipurpose plant species mainly for medicine, food, firewood, construction, fencing, income resource, honey bee forage and furniture making (Table 8). Hence, the sustainable use of these top-ranked species is under questions, for example the high loss of *Syzygium guineense* in the community area. Generally, the use matrix ranking showed that these wild edible plants were at conservation risk because of over exploitation for their additional uses for different purposes. In addition to this

information, some edible wild plants have unique uses. For example *Phoenix reclinata* is one of the wild edible plants with diversity uses in the local people. The uses of these plants are to making household furniture like mat, hat, basket and it has great contribution in local ceremonies of community.

Table 8: Average score for direct matrix ranking of the 10 wild edible plant species. (Med = medicine, Fen = Fence, Con = Construction, Fw = Fire wood, Fur = Furniture, Incs = Income source, HBF = Honey bee forage, T = total, R = Rank and (0 = not used, 1 = least used, 2 = less used, 3= good used, 4 = very good, 5 = excellent)

Plant species	Use categories of respondents									
	Med.	Fen	Con.	Fw	Fd	Fur.	Incs	HBF	T	R
Olea welwitschii	4	2	3	3	3	0	0	0	15	10th
Flacourtia indica	0	3	4	5	3	0	1	0	16	9th
Carissa spinarum	1	4	1	2	5	0	0	4	17	8th
Piper capensis	3	1	4	5	3	1	4	0	21	7th
Rhytigynia neglecta	1	3	4	5	3	3	1	3	23	6th
Mimusops kummel	4	2	4	5	4	1	3	2	25	5th
Clausena anisata	3	3	4	4	3	2	3	4	26	4th
Fagaropsis angolensis	4	2	3	5	4	3	4	2	27	3rd
Syzygium guineense (Willd.) DC.*Supsp Afromontanum*	1	4	5	5	5	2	5	4	31	2nd
Cordia Africana	3	3	5	5	3	5	5	5	35	1st

4.13. Threats to Wild Edible Plants

WEPs are like other plant species threatened due to various human activities and natural causes such as land use change (expansion of agricultural lands), developmental activities (road construction and urbanization), habitat destruction (timber harvest, fire wood collection, wild fire), drought and over harvesting were the main conditions that decreased the diversity of

species and qualities of wild edible plants. The degrees of threats to wild edible plants vary among the different areas of the district. According to respondents from Shabe Dasso and Mirgano Basso *Ganda's* forest clearing for expansion of agriculture and coffee cultivation is the main reason for destruction of wild edible plant species. In Atiro Gafare *Ganda*, the conversion of natural forest to satisfy a growing need of grazing land to support high livestock density. Similarly, in Yanga Dogima, respondents described fuel wood collection, overgrazing and construction of road to equally threatening wild edible plants species (Table 9). This result was supported by the study conducted on Ethnobotanical study of wild edible plants in Derashe and Kucha Districts, Southern Ethiopia by Kebu Balemie and Fassil Kebebew (2006). Also, the work of Dessalegn Ayele (2017) agrees with this finding, as he reported the agricultural expansion as the main threat to wild edible plant species. Another major threat to wild edible plants were destruction and cutting of tree plants for different purposes in Yanga Dogima and Atiro Gafare.

Table 9: Pair wise ranking of threats to wild food plants used and their degree of effect values given 1 to 5. (1= the least destructive threat and 5 = the most destructive threat) and (Y= Yanga Dogima, S= Shabe Dasso, M= Mirgano Basso and Atiro Gafare).

Respondents from each *Gandas*														
Factors	Y1	Y2	Y3	S1	S2	S3	M1	M2	M3	A1	A2	A3	Total	Rank
Agricultural $ coffee cultivation	4	4	4	4	5	5	4	4	5	4	3	4	50	1st
Cutting trees	5	4	5	3	4	4	3	4	4	3	4	4	47	2nd
Road construction	3	4	4	4	4	5	3	3	4	4	4	4	46	3rd
Overgrazing	3	4	4	3	4	3	3	4	3	5	4	5	45	4th
Fuel wood collection	4	4	4	4	3	3	3	4	3	4	4	3	43	5th

4.14. Conservation and management practices of WEPs in study area

Human activities like expansion of agriculture, fuel wood collection, and construction of roads were the factors that threat the wild edible plants in the study area. There were some conservation methods like planting WEPs in the form of live fences and sacred sites (in Churches or Mosques) around schools and in farm margins. This shows that there are insufficient conservation activities in place to safeguard the wild edible plants.

4.15. Scope for future studies

The dietary analyses of Ethiopia were found in low level when compared to studies in other countries. There have not been good nutritional analyses of WEPs in Ethiopia. In South Africa, Mexico, Nigeria and India depth nutritional analyses of many WEPs were reported (TenaRegassa, 2016). In Ethiopia the nutritional values of *Ziziphus spina christi* (L) (Rhamnaceae), *Balanites aegyptiaca* (L.) (Balanitaceae) and *Grewia flavescens* A. (Tiliaceae) indicates that the presence of full carbohydrates, proteins and lipids. In addition to nutritional value, anti-nutritional and toxicity components of WEPs from different countries have been reported. But, such like analyses have not been done for WEPs of Ethiopia (Tena Regassa, 2016).

5. Conclusions and Recommendations

5.1. Conclusions

The local community of the study area use different wild edible plants as a source of food. The wild edible plants are widely used by all age groups only during drought or famine season. In the study area, about 38 wild edible plants belonging to 27 families were collected and documented. Women knew more number of WEPs than men. Women and children were the main gatherers of WEPs followed by men and all household members. Fruits and leaves were the most predominantly consumed plant parts in the study area. In case of their modes of consumption, some species of WEPs are eaten raw and others are consumed after processed. For example; the fruits of *Ficus vasta* consumed in both raw and after its fruits are dried.

Some species of WEPs have amazing unique uses in addition to their nutritional value. Moreover, the dried leaves of *Piper capensis* were used by the local community to make the throat clear and increase the audibility of the sound produced, especially for Religious ceremonies and local musicians. The other amazing use of WEPs was that of *Phoenix reclinata.* Their leaves and stems are important in making of several household furniture's such as mat, hat, local bag or baskets as well as it is important in different local ceremonies.

Edible wild plants studied are also used as a source of traditional medicine. Some of Wild edible plants are important in construction, agricultural tools, fencing role, fuel wood, furniture, income source, medicine source and in others roles. *Cordia africana* was reported as the main multipurpose species followed by *Syzygium guineense*. The main threats to WEPs in the district were developmental activities and destruction of habitat by different factors.

5.2. Recommendations

There are different gaps in our understanding of WEPs and associated indigenous knowledge in Shabe Sombo district. Therefore, the following are recommended for future actions:

- Conservation of wild edible plant resources is very important because their sustainable use can generate high level of employment and source of income.
- Encourage the local people to grow WEPs in the home gardens and mixing WEPs with crops in the farm lands and live fences will be important.
- Another option is to support the activities of plantations of WEPs in degraded and degrading soil environments to make them beneficial product.
- Furthermore, conducting several researches on the toxicity and nutritional uses of the reported WEPs is recommended to ensure safety of consumer.

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Appendices

Appendix 1: Questionnaire Data sheet for collection of wild edible plants

1. Local/Vernacular name……..Voucher /Collection No...……

2. Plant identified as ……... (Botanical name)

3. Place of collection ……. (Name of the village)

4. Informants profile

Name	Sex (M/F)	Age	Occupation

5. Plant Parts Used **a)** leaf **b)** stem **c)** root **d)** bulb **e)** tuber **f)** flower **g)** bark

6. Modes of Consumption_____

7. Habitats of the Plant_____

8. Availability period _____

9. Local availability status: a) Abundant b) Common c) Not so common d) Rare

10. Have it marketable status? a) Yes b) No)

11. Another uses of the wild edible plants_____

12. Threats of the plant _____

13**.** Main collector: a) men b) women c) children d) all member of household

14. How the knowledge of WEPs was being transferred and practiced? _____

_____

Date: ----------

Appendix 2: List of wild edible plants, Habits, parts used and availability status

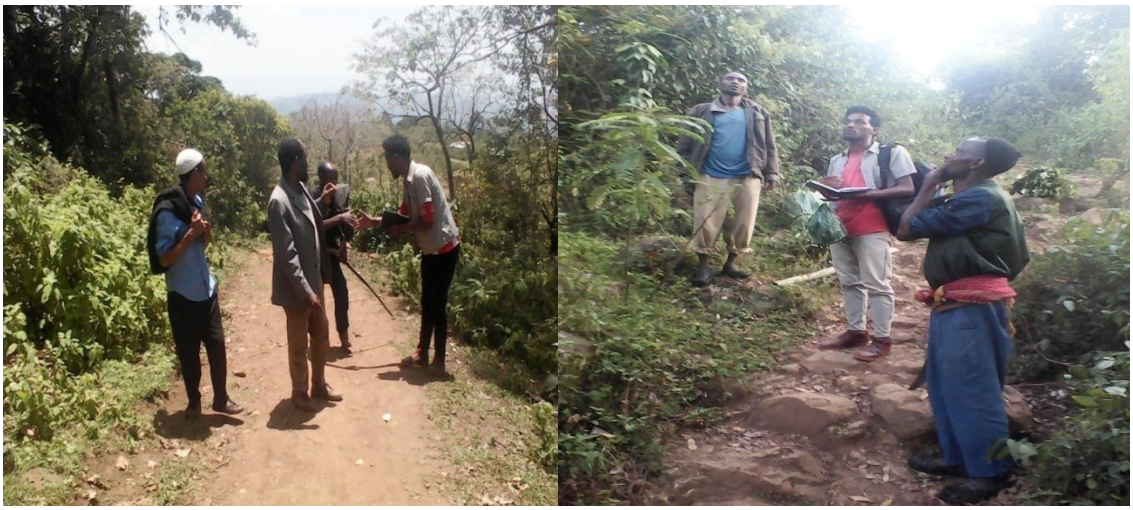
N<u>o</u>	**Scientific name**	**Family**	**Local name (Afaan Oromoo)**	**Habit**	**Part used**
1	*Aframomum corrorima*	Zingiberaceae	Ogiyoo	H	Tuber
2	*Allophylus abyssinicus*	Sapindaceae	Sehoo	T	Fruit
3	*Amaranthus sparganium cephalus*	Amaranthaceae	Liimaa	H	Cooked Leaf
4	*Carissa spinarum*	Apocynaceae	Agamsa	Sh	Fruit
5	*Clausena anisata*	Rutaceae	Ulmaayi	Sh	Fruit
6	*Colocasia esculenta*	Araceae	Godarree lagaa	H	Leaves & tuber
7	*Commelina Africana*	Commelinacea e	Ushummii	H	Tuber
8	*Cordia Africana*	Boraginaceae	Waddessa	T	Fruit
9	*Cypbomandra betacea*	Solanaceae	Amburijjii	Sh	Seed
10	*Dioscorea bulbifera*	Dioscoreaceae	Wacinoo	L	Tuber

N_o	Scientific name	Family	Local name	Habit	Part used
11	*Dioscorea schimperiana*	Dioscoreaceae	Kottee harree	L	Seed
12	*Manilkara butuji*	Sapotaceae	Muttujjii	T	Fruit
13	*Embelia schimperiana*	Myrsinaceae	Hanquu	Sh	Fruit
14	*Erucastrum abyssinicum*	Brassicaceae	Simbiree	H	Cooked Leaf
15	*Ficus sychomorus*	Moraceae	Arbuu	T	Fruit
16	*Ficus sur*	Moraceae	Odaa	T	Fruit
17	*Ficus vasta*	Moraceae	Qilxuu	T	Fruit& stem
18	*Flacourtia indica*	Flacourtiaceae	Akuukkuu	T	Fruit
19	*Landolphia Buchananii*	Apocynaceae	Yeboo (hidda geeboo)	L	Fruit
20	*Lantana trifolia*	Verbenaceae	Midhaan durbaa	Sh	Fruit
21	*Fagaropsis angolensis*	Rutaceae	Sigiluu	T	Fruit
22	*Mimusops kummel*	Sapotaceae	Qolaatii	T	Fruit
23	*Myrsine Africana*	Myrsinaceae	Qacama	Sh	Fruit
24	*Olea welwitschii*	Oleaceae	Baya	T	Fruit
25	*Passiflora edulis*	Passifloraceae	Kookii	L	Fruit
26	*Peponium vogelii*	Cucurbitaceae	Moxoxxoo	L	Fruit

N_o	Scientific name	Family	Local name	Habit	Part used
27	*Phoenix reclinata*	Arecaceae	Mexxii	T	Fruits, shoots& buds
28	*Physalis peruviana*	Solanaceae	Tinii	H	Seed
29	*Piper capensis*	Piperaceae	Tunjoo	T	Fruit
30	*Plectranthus punctatus*	Lamiaceae	Dinnichoo	H	Tuber
31	*Psidium guajava*	Myrtaceae	Shafaafee	Sh	Fruit
32	*Rhytigynia neglecta*	Rubiaceae	Mixoo	T	Fruit
33	*Rubus apetalus*	Rosaceae	Deg-barbaree	Sh	Fruit
34	*Rubus erlangeri*	Rosaceae	Goraa arbaa	Sh	Fruit
35	*Rubus steudneri*	Rosaceae	Goraa	Sh	Fruit
36	*Syzygium guineense* (Willd.) DC. subsp. *Guineense*	Myrtaceae	Gooshuu	T	Fruit
37	*Syzygium guineense* (Willd.) DC.*Sup.sp afromontanum*	Myrtaceae	Baddessa	T	Fruit
38	*Vepris dainellii*	Rutaceae	Hadheessa	T	Fruit

Appendix 3: Some photographs illustrating ethnobotanical field data collection

A. Focal group discussion with small groups (Photos taken by Kibru Qano)



B. Individual interviews at field (Photos taken by Kibru Qano)