

## ETHNOBOTANICAL SURVEY OF WILD EDIBLE TREES AND SHRUBS OF CENTRAL TIGRAI, NORTHERN ETHIOPIA

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### ABSTRACT

Wild edible trees and shrubs play an important contribution to food and traditional medicine. Many valuable wild edible plants are familiar to certain areas or to certain communities but are unknown to others. So, this research is done with the objective to study the type of valuable wild edible trees and shrubs in the study area. A simple random sampling technique was used to select 173 respondents. In addition, focus group discussion was also held with 40 key informants. Ethnobotanical data were collected in the presence of local administrators. A total of 22 wild edible trees and shrubs belonging to 14 families were recorded. Moraceae families were the dominant families in the area. The majority (63.6%) of Wild edible trees were found in natural forests followed by riparian forests (27.3%). All of the wild edible tree species (100%) recorded in this study were eaten their raw fruit part. of the total wild edible trees and shrubs recorded, 18.2% were used for medicinal purposes, and 32% were used for construction. Even though the income contribution of the wild edible trees is not comparable to the income of annual crops, an important contribution can be obtained from the wild edible trees especially in the dry season. Overgrazing and agricultural expansions are critical factors for threatening wild and semi-wild plants. High conservational demand of the most endangered wild edible tree species like *Syzigium guineense*, *Tamarindus indica*, *Ximenia americana*, *Ficus vasta*, *Ficus sycomorus*, *Mimusops kummel*, and *Diospyros mespiliformis* is important.

**KEYWORDS:** wild edible, endangered, mode of consumption.

### INTRODUCTION

Millions of people depend on wild resources including wild edible plants in many developing countries to meet their food needs in time of food crisis (Powell *et al.* 2013; Balemie and Kebebew, 2006). Wild edible plants were the important forest resources, which helps in improving food security of tribal people and rural community. Over 53 million tribal people in India and about 60 per cent of the rural communities who directly rely on forest resources for their day-to-day requirements (Kandari *et al.*, 2012). Wild edible plants are alternative sources of nutrients and bioactive compounds, such as vitamins (B9, C and E), minerals, fiber, unsaturated fatty acids, and phenolic compounds (Pinela *et al.*, 2017). In Ethiopia, there are about 370 indigenous food species out of which 182 species are shrubs/trees with edible fruits/seeds. Wild edible trees and shrubs play important roles in African countries. Several studies have demonstrated the a income sources and as supplementary food sources during times of crisis (Balemie & Kebebew 2006; Teketay and Eshete 2004; Seyoum, 2015). Wild

edible plants have the potential to supplement for a variety of crops in drought season and hence, should be credited. According to Mulugeta *et al.*, (2010), there is a chronic malnutrition problem in Tigray. The energy and nutrient density of the complementary foods are low as the foods were prepared from a limited number of local staple cereals. According to Horo and Topno (2015), 20 wild plants belong to 13 families and 19 genera are rich in protein, calories, carbohydrates, potassium, iron, calcium, vitamin A and vitamin C. So, there is still a need for documentation, nutritional analysis and domestication of wild edible plants to assist in the nationwide effort to combat food insecurity and ensure dietetic diversity (Lulekal *et al.*, 2011).

During challenges of climate variability and drought, wild edible plant has the potential to resist as compare to cereal crops and can standby nutritionally. The status of research and development in Ethiopia, specifically in Tigray is generally low. Most of the wild edible plants are threatened because the associated traditional knowledge is in danger of being lost for the present and coming

generation which also leads to depleting its potential resource through deforestation or any other. Similarly, the research and development regarding wild edible plant diversity, contribution to nutrition, and conservation approaches in Tigray are not sufficient. Therefore, botanical surveys will be conducted throughout the study area to investigate and document the wild edible plants traditionally used.

Wild plants have received great importance at different places and times of the human history given their ability to provide nutrients during scarcity periods and protection for minor health conditions (Torija-Isasa and Matallana-González, 2016). Wild edible plants may include trees, shrubs vegetables and lower plants. Our main focus in this paper is the type of wild edible plants that are under the category of wild edible trees (WETs) and shrubs only. Many Wild edible trees are still consumed for their dietary value in numerous communities around the globe. 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 (Lockett and Grivetti, 2000). Despite the primary reliance of most agricultural societies on staple crop plants, the tradition of eating Wild edible Plants products continues in the present day. In addition to their role in reducing food gaps during periods of drought or scarcity, WEPs play an important role in maintaining livelihood security for

many people in developing countries (Afolayan and Jimoh, 2009).

Many valuable wild edible plants are familiar to certain areas or to certain communities but are unknown to others (Uprety *et al.*, 2012). Despite the fact that, Tigray region is the home of many more indigenous wild edible trees and shrubs, studies on the assessment and utilization of wild edible trees are very minimal, almost null. Therefore, this study is done with the objective of assessing the types of wild edible trees and shrubs and evaluates their livelihood income contribution.

## MATERIAL AND METHOD

### Study area

This study was conducted in two districts of central zone of Tigray which is bordered on the east by Eastern, on the south by South Eastern, on the west by North Western and on the north by Eritrea. The study area is located between 38°30'0"E to 39°0'0"E (Figure 1). The study districts were grouped under two agro ecologies namely; midland agro-ecology (Ahferom district) and lowland agro ecology (Mereb leke district). The total population of Ahferom and Mereb leke districts is 173,700 and 107,218 respectively (CSA, 2007). The main reason for making such clustering is the assumption that, the two agro-ecologies may have different utilization practice.

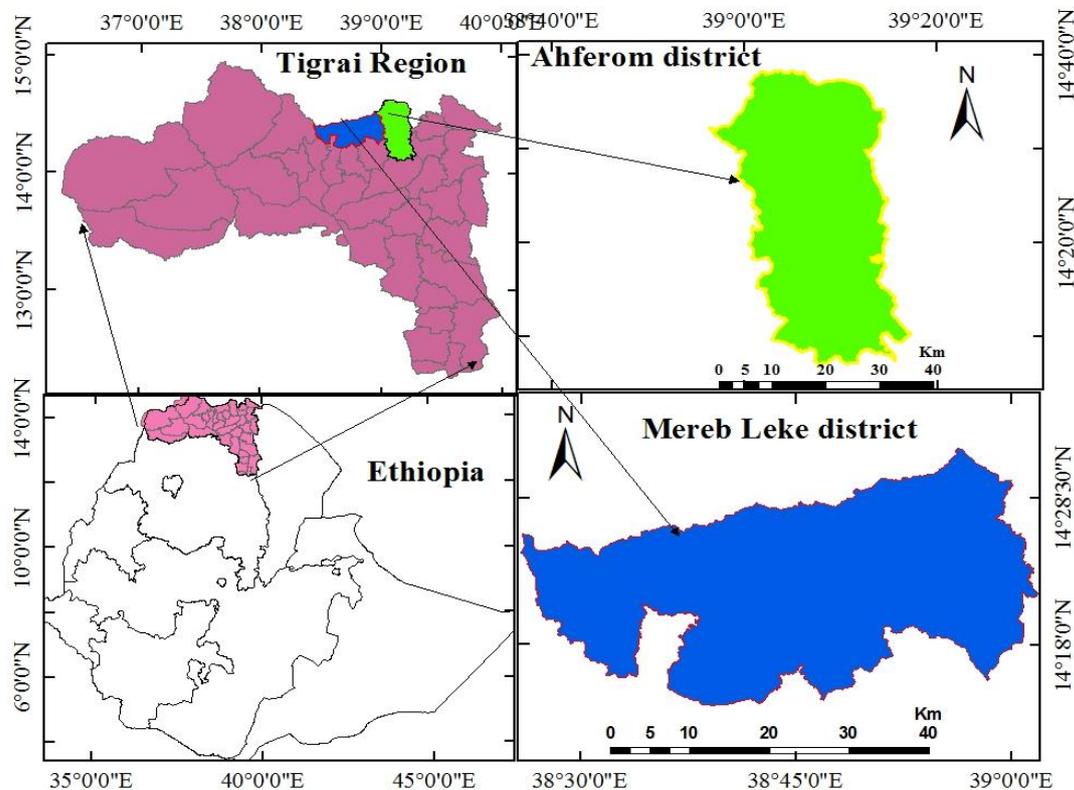


Figure 1: Map of study areas.

### Sampling methods

In each district, farmers were selected through simple random sampling method to select the respondents for the wild edible tree species. A total of 173 farmers were interviewed using a semi-structured interview. Focus group discussion was also made in each selected kebeles with 40 key informants. Ethnobotanical data were collected in the presence of local administrators. Good specimens (those bearing flowers and/or fruits) of all the wild edible plants identified by the informants were collected as voucher specimens. The collection was made with the informants during guided field walk. Along with the collection, the field activities included taking notes on the plants and the associated habitat, conservation demand, mode of consumption, and the market survey. Preliminary identification of wild edible species was done in the field based on published guides of useful trees and shrubs of Ethiopia (Bekele *et al.*, 1993; Berihu and Molla 2017). Each specimen was given a collection number and scientific and/or local name when possible. Standard procedure was followed in pressing the specimens, which were then brought to the National Herbarium (ETH), Addis Ababa University, the department of biology where they were allowed to dry, deep-frozen and determinations made using taxonomic keys and descriptions. Further refining of determinations was made by visual comparison with authenticated

herbarium specimens and finally checking the accuracy by a senior plant taxonomist. The socioeconomic values of indigenous wild edible tree species was studied through market surveying at different seasons.

### Data analysis

The collected data was analyzed using descriptive statistics, where the results are summarized and presented using tables, figures, and percentages. In doing those analyses, SPSS version 20 was used. Preference ranking was performed to analyze the most popular and preferred wild edible plants, at least in the context of the people who used them during food shortage in the area. Peoples' preferences of wild edible plants were undertaken with informants to determine their order of cultural importance across a community.

## RESULTS AND DISCUSSION

### Demographic Characteristics of the Respondents

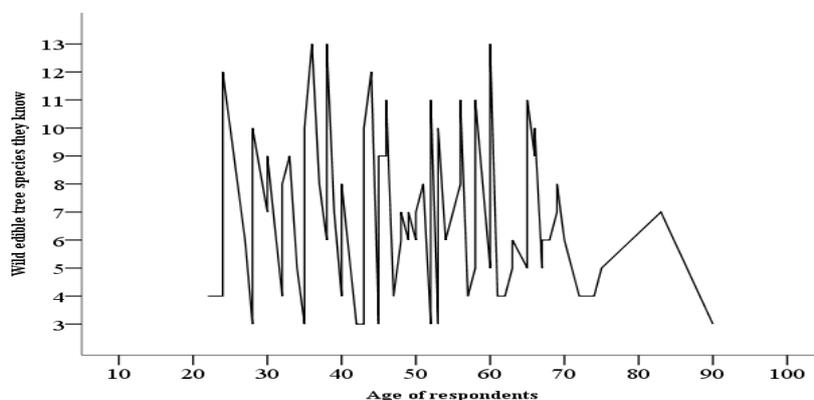
The mean age of the respondents was found to be 48. the age ranges of the respondents were found to be 22-85. This means we have a very good age distribution to collect diverse informations from varying age groups. Females constitute 22% of the total respondents (Table 1).

**Table 1: Respondents participated in the semi-structured interviews (Mereb leke n=76 and Ahferom (n= 97) total n=173.**

Demographic Characteristics	Ahferom	Mereb leke	Total mean
Age (mean)	50.9 ± 1.9	43.8 ± 1.8	47.9 ± 14.8
Gender (male%, female %)	(77%, 23%)	(78.7%, 21.3%)	77.8%,22.2%
Education (primary, secondary, read and write, illiterate)%	25.7%, 3%, 9%, 62.1%	25.5%,2%, 4.2%, 68%	25.7%,2.7%,7%, 64.6%
Religion (Christian, Muslim)	(100%, 0%)	(100%, 0%)	(100%, 0%)
Occupation (Agriculture, trade, Gov't recruited)	(100%, 0%, 0%)	(100%,0%,0%)	(100%, 0%, 0%)
Family type (male headed, female headed)	89.4%,10.6	100%,0%	93.8%,6.2%

The relationship between age of respondents and the number of wild edible trees they know (Figure 2) indicate that the active age for knowing the wild edible tree and shrubs is between 35 and 65 years. This may

indicate lack of sufficient knowledge of the young individuals in the lower age (22-35 years). Not only this, peoples may tend to forget the wild edible trees for aging reason (>65 years).



**Figure 2: Relationship between age of respondents and number of wild edible plants they know.**

A total of 22 wild and semi wild trees and shrub species representing 16 families were recorded. Of these wild edible trees and shrubs, 8 (36.4%) were tree species belonging to 8 families, and 10 (45.5%) were shrubs species representing 10 families and the rest 4 (18.1%) shrub species belongs to 4 families (Table A1). Moraceae were the most dominant family with species and followed by Malvaceae, Ebenaceae, Rhamnaceae, and Boraginaceae.

#### Edible parts and mode of consumption

Moraceae families (4 species) are the dominant families followed by Tilliaceae (3 species). All of the wild edible tree species (100%) recorded in this study were eaten their raw fruit part. In contrast, Berihu and Molla (2017) found that 56% of the wild edible plants in southern

Ethiopia were harvested for their fruits and 14% were eaten boiled. Of these, 20 species (91%) of the wild edible plants were eaten in raw while some of them like *Tamarindus indica* (4.5%) were eaten both in raw and in juice form. *Mimusops kummel* (4.5%) raw and roasted. The majorities (73%) of the WETs were found to be trees and the remaining (27%) were shrubs. This is in agreement with Berihu and Molla (2017). Ashagre *et al.*, (2016) also found that the maximum number of edible plants was harvested for their fruits.

#### Additional use of wild edible trees

The respondents (100%) say that, all the edible trees and shrubs can be used as fuel wood. of the total wild edible trees and shrubs recorded, 18.2% were used for medicinal purpose, and 32% were used for construction.

**Table 2: Additional use of wild edible trees.**

	Additional use	Species (%)	List of species
1	Medicine	18.2	<i>C.africana, B.aegyptiaca, D. mespliflorum, T.indica</i>
2	Construction	31.8	<i>C.africana, D.mespliformis, P.viridiflorum, F.vasta, F.sycomorus, T.indica, S. guineense</i>
3	Fuel wood	100	All the list species
4	Forage	31.8	<i>C.spinorum, C.africana, F.indica, Z.spinschristi, B.aegyptiaca, X.americana, R.natalensis,</i>
5	Soil fertility	22.7	<i>Z.spina christi, B.eagyptiaca, C.monoica, C.africana, Z.mauritiana</i>

#### Habitat preference

The wild edible trees were from various habitats including from natural forest, farmland, riparian forest, and homestead agroforestry system. The majorities (63.6%) of WETs and shrubs were found in natural

forests followed by riparian forests (27.3%) and this is in line with (Ashagre *et al.*, 2016). Farmlands and homestead agroforestry (18.2% each) are the least contributing to the WETs (Table 3).

**Table 3: Habitat preference of the wild edible trees.**

No.	Habitat	Species (%)	List of species
1	Natural forest	63.6	<i>C.spinorum, C.monoica, B.eagyptiaca, D. mespliformis, T.indica, F. palmata, E. racemosa, M.kummel, X.americana, R.natalensis, G. flavescens, G. ferruginea, G. villosa, F.indica</i>
2	Farmland	18.2	<i>Z.spina christi, Z. mauritiana, B.egyptiaca, C.africana</i>
3	Riparian forest	27.3	<i>P. viridiflorum, F.vasta, F.sycomorus, T.indica, D.mespliflorum, S.guineense</i>
4	homestead	18.2	<i>C.africana, B.eagyptiaca, F.indica, Z.spina christi</i>

#### Conservation demand

This study shows that the majority of the wild edible trees and shrubs (64%) need high conservation demand while the rest 34% require moderate conservation demand. The potential source of wild edible trees is now

shrinking. Agricultural land expansion, overutilization, and free grazing are the major threats to the conservation of wild edible plants in the study area (Balemie and Kebebew 2006; Berihu and Molla 2017).

**Table 4: conservational demand of edible trees.**

No.	Conservation demand	Species (%)	List of species
1	Not required	0	
2	Required	36	<i>F. palmata, E. racemosa, R.natalensis, F.indica, B.aegyptiaca, Z.spinschristi, Z.mauritiana, C.africana</i>
3	Highly required	64	<i>P. viridiflorum, F.vasta, F.sycomorus, T.indica, D.mespliformis, S. guineense. V.madagascarensis, M.kummel, G. flavescens, G. ferruginea, G.villosa willd, C.spinorum, C.monoica, X.americana</i>

The degree to which conservational demand is required depends on the present status of the wild edible trees and

shrubs. Conservational demand is assumed to be high if the current status of the wild edible trees is low.

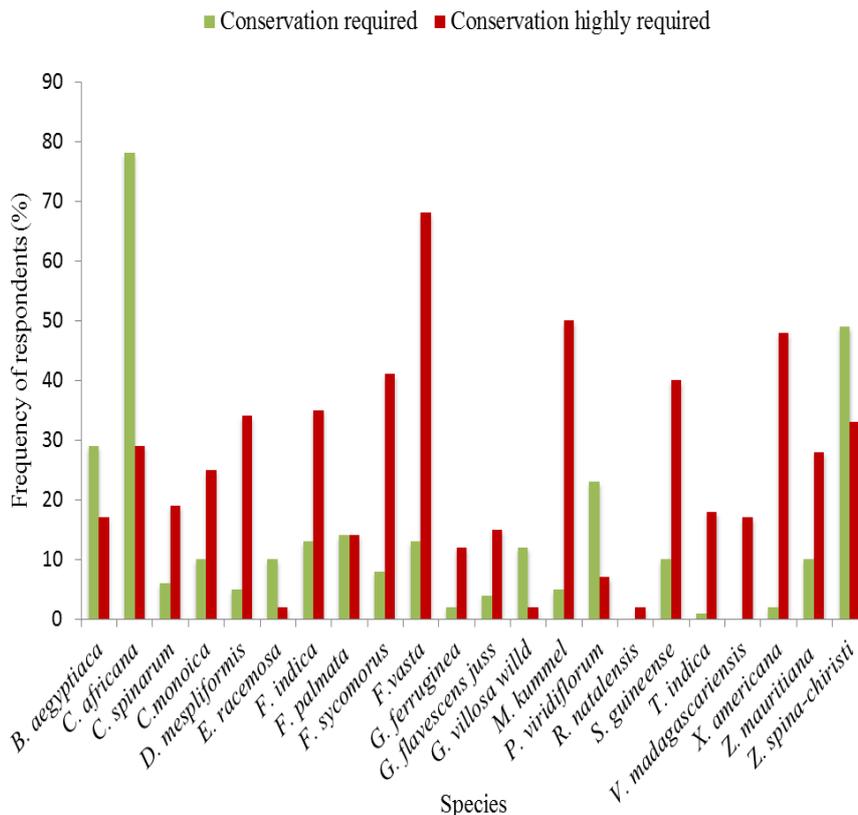


Figure 3: Conservation demand requirement of wild edible trees and shrubs.

#### Market survey of some WETs

Regardless of their availability in the market, the market price of *M. kummel* was found to be 1179.6 ETB/annum/tree. In addition, the market price of *D. mespiliformis* was found to be 1116.48 ETB/annum/tree (Table 5). This indicates that Even though the income contribution of the wild edible trees is not comparable to

the income of annual crops, important contribution can be obtained from the wild edible trees especially in the dry season and this is in agreement with (Geng *et al.*, 2016; Amente, 2017). Socio economic survey of wild edible fruits indicates that, rural and tribal people depend on wild edible fruits for various purposes (Pai *et al.*, 2019).

Table 5: market survey of the wild edible trees.

No	Commercial wild edible	Average harvested (kg/tree/year)	Market price (birr/kg)	Total birr /tree/year
1	<i>Cordia africana</i>	128.7	6	772.2
2	<i>Ziziphus spina christi</i>	88.7	8.6	761.82
3	<i>Diosperous mespiliformis</i>	116.3	9.6	1116.48
4	<i>Balanites aegyptiaca</i>	114.2	8.5	970.7
5	<i>Tamarindus indica</i>	55.25	9	497.25
6	<i>Mimusops kummel</i>	98.3	12	1179.6
7	<i>Ximenia americana</i>	67.6	11	743.6

## Supplementary materials

Table A1: Complete list of the wild edible trees and shrubs. T=Tree, S=Shrub.

No.	Scientific name	Local name	Family	Growth habit
1	<i>Balanites aegyptiaca</i> (L)Delile	Mekie	Balanitaceae	T
2	<i>Carissa spinarum</i>	Agam	Apocynaceae	S
3	<i>Cordia africana</i>	Akui	Boraginaceae	T
4	<i>Cordia monoica</i>	Akui tsirgah	Boraginaceae	T
5	<i>Diospyros mespliformis</i>	Aye	Ebenaceae	T
6	<i>Euclea racemosa</i>	Kiliaw	Ebenaceae	S
7	<i>Ficus indica</i>	Qolqual bahri	Cactaceae	T
8	<i>Ficus palmata forssk</i>	Beles adgi	Moraceae	T
9	<i>Ficus sycomorus</i>	Sagla	Moraceae	T
10	<i>Ficus vasta</i>	Daero	Moraceae	T
11	<i>Grewia ferrugiginea</i>	Tsenqui	Tiliaceae	S
12	<i>Grewia flavescens juss</i>	Mesequa	Tiliaceae	S
13	<i>Grewia villosa willd</i>	Habenev	Tiliaceae	S
14	<i>Mimusops kummel</i>	Kummel	Sapotaceae	T
15	<i>Pittosporum viridiflorum</i>	Chekemte	Pittosporaceae	T
16	<i>Rhus natalensis</i>	Tetealo	Anacardiaceae	S
17	<i>Syzygium guineense</i>	Liham	Myrtaceae	T
18	<i>Tamarindus indica</i>	Humer	Fabaceae	T
19	<i>Vangueria madagascariensis</i>	Harenkerf	Moraceae	S
20	<i>Ximenia americana</i>	Muleo	Olacaceae	T
21	<i>Ziziphus abyssinica</i>	Gaba adgi	Rhamnaceae	T
22	<i>Ziziphus spina-chiristi</i>	Gaba	Rhamnaceae	T

Table A2: Major threats of wild edible trees and shrubs.

Species	Threats to wild edible					
	Agri.exp	fire	Disease & pest	Over grazing	Drought	Over utilization
<i>C. africana</i>	✓			✓		✓
<i>S. guineense</i>					✓	✓
<i>F. vasta</i>					✓	
<i>F. sycomorus</i>					✓	
<i>X. americana</i>				✓	✓	
<i>M. kummel</i>				✓		
<i>Z. spina christi</i>	✓			✓		✓
<i>C. spinarum</i>	✓			✓		
<i>F. indica</i>	✓			✓		
<i>B. aegyptiaca</i>	✓			✓		✓
Rank	2	5	5	1	4	3

## CONCLUSION AND RECOMMENDATION

In this study, a total of 22 taxa of wild and semi-wild edible plants belonging to 16 botanical families were identified. The most important and commonly used species for livelihood improvement ranked by the respondents were *C.africana* and *Z.spina-chiristi*. Over

grazing and agricultural expansions are the critical factors for threatening wild and semi-wild plants. The most endangered wild edible tree species listed by the respondents were *S.guineenes*, *T.indica*, *X.americana*, *F.vasta*, *F.sycomorus*, *M.kummel* and *D.mespliformis* these species needs a conservational demand. Government and non-governmental organizations should

be give more emphasis for wild and semi-wild species to be raised in the available nurseries.

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