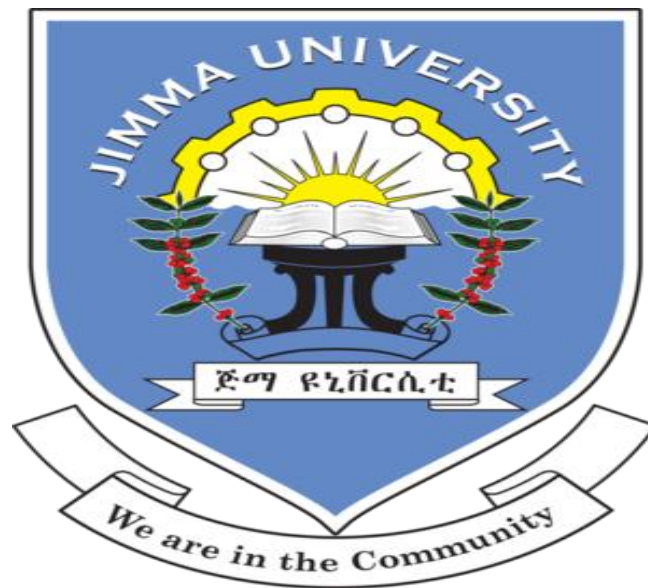


JIMMA UNIVERSITY
COLLEGE OF NATURALSCIENCES
SCHOOL OF GRADUATE STUDIES
DEPARTMENT OF BIOLOGY



ASSESSMENT OF TRADITIONAL USES OF AROMATIC PLANTS
AMONG THE PEOPLE OF WAYU TUKA DISTRICT, EAST
WOLLEGA ZONE, OROMIA REGION, WESTERN ETHIOPIA

By: Alemu Hailu

November, 2018

Jimma, Ethiopia

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Assessment of traditional uses of aromatic plants among the people of
Wayu Tuka District, East Wollega Zone; Oromia Region, Western
Ethiopia

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Table of contents

Contents	Pages
ACKNOWLEDGEMENTS.....	iii
LIST OF TABLES.....	iv
1. Introduction.....	1
1.1 Background of the study.....	1
1.3 Objectives of the study.....	4
1.3.1 General objective.....	4
1.3.2 Specific objectives.....	4
1.4 Significance of the study.....	4
2. Literature review.....	5
2.1 Definitions of aromatic plants.....	5
2.2 Historical background of aromatic plants study.....	6
2.3 Aromatic plants in Ethiopia.....	7
3. Materials and methods.....	10
3.1 Descriptions of the study area.....	10
3.1.1 Geographical Location.....	10
3.3 Respondent selection.....	13
3.4 Data collection of traditional uses of aromatic plants.....	14
3.5 Data Analysis.....	15
3.5.1 Preference and direct Matrix ranking.....	15
3.6 Ethical issue.....	16
4. Results and Discussions.....	17
4.1 Results.....	17
4.1.1 Distribution and growth form of aromatic plants in Wayu Tuka District.....	17
4.1.2 Taxonomic diversity of the identified plants in the study area.....	18
4.1.3 Respondents' age and their knowledge on aromatic plants.....	19
4.1.4 Educational levels of the respondents.....	20

4.1.5 The indigenous knowledge of local people	21
4.1.5.1 Classification of aromatic plants by the peoples.....	21
4.2 Habits of the aromatic plants identified in the area	29
4.3 Respondents’ consensus of total identified plants	30
4.3.1The number of aromatic plants reported in each study site	30
4.3.2 Aromatic plants cited by largest number of respondents.....	31
4.4 Different purposes of Aromatic plants.....	32
4.4.1 Aromatic woody plants and their purposes.....	32
4.4.2 Ritual plants of the study area.....	33
4.4.3 Insects repelling aromatic plants in the study area	34
4.4.4 Medicinal aromatic plants of the study area	34
4.4.5 Parts aromatic plants used for different purposes in the study area.....	37
4.5 Ranking of the aromatic plants in the study area.....	40
4.6. Discussion	44
4.6.1 Spices cultivation of the study area	44
4.6.2 Natures and aroma parts of the plants used in the study area	44
4.6.3 Different purposes of aromatic plants in the study area	45
4.6.5 The plants mostly used for multipurpose in the study area	47
4 6.6 Conservation of the identified plants in the study area.....	52
4.6.8 Habits of aromatic plants in the study area.....	54
5.1 Conclusions.....	55
5.2 Recommendations.....	56
6. References.....	58

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LIST OF TABLES

Table 1: Division of the study area land for different purposes	12
Table 2: The aromatic plants used as spices, food, and sauce supplement and medicines	22
Table 3 : Plant that have certain aroma and considered as stimulant by the local peoples	25
Table 4: Incense Plants of the study area	26
Table 5: Fumigator aromatic plants that the fresh leaves or flowers are used	27
Table 6: Plants with aromatic root	28
Table 7: Different purposes of Aromatic woody plants from the identified group.....	33
Table 8: Medicinal aromatic plants in the study area	35
Table 9: Multipurpose of aromatic plants in the study area.....	39
Table 10 : The top 9 aromatic plants with multipurpose of the study area	40
Table 11 : Result of Preference ranking.....	41
Table 12: Direct matrix ranking result.....	42
Table 13: Results of Paired comparison for the selected plants.....	43

LIST OF FIGURES

Figure 1: Map of the study area	11
Figure 2: Distribution of aromatic plants in the study area.....	18
Figure 3: Families of the identified aromatic plants	19
Figure 4: The relationship between Educational status of respondents and aromatic plants	20
Figure 5: Study sites and number of plants cited.	30
Figure 6: Habits of identified plants in the study area	29
Figure 7: Top ten plants cited by respondents	31
Figure 8: Parts of the aromatic plants used for multipurpose in the study area	37

LISTS OF APPENDENCES

Appendix 1: Check lists of questions translated in to Afan Oromo	66
Appendix 2:Lists of Key informants participated in different in comparisons of selected plants used in ranking techniques.....	69
Appendix 3: Lists of aromatic plants of the study area	70
Appendix 4: photo samples of aromatic plants in in study sites during field observation	71
Appendix 5: All the families under which the identified plants found in the study area	73
Appendix 6: The uses of parts of identified plants in the study area with certain aroma	82

ABSTRACT

Assessment of traditional uses of aromatic plants was carried out in Wayu Tuka District from May 20, 2016 to October 5, 2017. Total number of respondents was 365, in which 318 (87.12%) were male and 47 (12.88) were female. They were randomly selected from five study sites to distribute questionnaires. The respondents were grouped into three groups of age 20-40 which was 234 (64.11%), 41-60 which was 98 (26.85%) and above 60 which was 33 (9.04%). The total number of key informants was 20 which were 17 male and 3 female for specific investigation. Therefore pertinent information was collected using questionnaire, semi-structured interview, field observations and discussions. The data gathered were entered in Microsoft Office Excel 2007 to be analyzed and summarized in more notable manner using descriptive statistical method such as tables, graph, frequencies and percentage. The aromatic plants collected from home garden (cultivated area) which was 23 (57.5%), from wild which was 15 (37.5%) plant species and from both which was 2 (5%). Totally 40 plant species were identified for their aroma and multipurpose. The plants habits were categorized into tree which represents 13 (32.5 %), shrub 6 (15%) and herb 21 (52.5 %). Taxonomically the plants were fall under 31 genera and 24 families, from which 8 of the families were Lamiaceae, Rutaceae, Asteraceae, Zingiberaceae, Solanaceae, Verbenaceae, Oleaceae and Alliaceae with 2-6 different plant species. Lamiaceae represents 6 (15%) of the total species; Rutaceae represents 4 (10%) while Asteraceae and Zingiberaceae represents 3 (7.5%) of the total species equally. The Solanaceae, Verbenaceae, Oleaceae and Alliaceae represent 5% individually while each of the rest 16 family represents 2.5% of the 40 plant species. The identified plants used among the peoples for medicine, spices, fumigation, incense, insect repellent, fire wood and ritual. The parts of the plants used were whole plant which contains 15 (37.5%) plant species, root which contains 3 (7.5%), seed 4 (10 %) plant species, leaf 9 (22.5%), wood 2 (5%), bark 2 (5%), bulb 2 (5%), leaf succulent 1 (2.5%) and rhizome 2 (5%) plant species.

Key words: *Aromatic plants, spice, fumigation, incense, sweet smell, Sustainable uses, traditional uses*

1. Introduction

1.1 Background of the study

Aromatic plants are plants which possess odoriferous oil in either of their organs or product, sometimes even in the whole plant which can be used even in the whole plant which can be used for cosmetics, pharmaceuticals, aromatherapy, soap and detergents manufacturing (Beeminat Mengesha *et al.*, 2010). The presence of aroma is due to different complex compounds in the form of fragrant essential oil naturally found in certain part of the plant (Skaria *et al.*, 2006). These compounds are oily and volatile in nature which are characterized by highly concentrated, low volume and high value products and they are almost paramount in all area of human activities. Aromatic plants are special class of plants used for their aroma and flavor (Joy *et al.*, 2005) and (Skaria *et al.*, 2006). Many of them are exclusively used also for medicinal purposes in aromatherapy as well as in various systems of medicine (Geetha, 2007). Many aromatic plants are spices which are defined as any dried, fragrant, aromatic or pungent vegetables or plant substances in whole, broken or in ground forms that contributes in flavoring foods and beverages (Beiminat Mengesha, 2015). It has been reported that there are different known phytochemicals found in variety of aromatic plants, may be in one or more of their parts. Phytochemical screening of these plants revealed the presence of secondary metabolites. These phytochemicals can be Alkaloids, phenols, Flavonoids, Saponins, essential oils and tannins (Okigbo *et al.*, 2009).

Aromatic plants are diverse and varied group of plants in terms of their growing habitat, phytochemical properties, traditional uses and their aroma parts. Some species are found only in ecosystems such as natural forest, which are still not domesticated. Others are cultivated for their common uses such as for food supplements and as food itself. Aromatic plants have particular fragrance and used for their aroma and flavor (Patel, 2014). They are group of plants that consist spices which are aromatic and fragrant traditionally using for special purposes in addition to food flavoring starting from ancient civilization. For example, *Allium sativum* and *Allium cepa* were basic components of incense, preservatives, ointments and cosmetics in Ancient Rome and Egyptians. *Cinnamum cassia* and *Cinnamomum verum* (Chinese cassia and Chinese cinnamon) were also transported from China to Egypt for these purposes (Mathewos Agize, 2014).

Aromatic plants are considered as multipurpose and are important to produce valuable substances, essential oils and oleoresins and original aroma useful for food, aromatherapy and soap, detergent manufacturing and cosmetic industries (Guteta Negasu *et al.*, 2016). Aromatic plants play a valuable role in economic, social, cultural and ecological aspects of local communities. Most of these plants are known as medicinal and aromatic plants that provide people with medicines to prevent disease, maintain health or cure ailments. Similarly a number of medicinal plants also produce essential oils as well as being used for perfumery (Joy *et al.*, 2002).

Aroma concentration of the plants and mode of utilization can be varied depending on plant species, the plant age, environmental conditions and genetic makeup (Guteta Negasu *et al.*, 2016). Aromatic plants are sources of curative elements used by a large population of Africans in the treatment of different known diseases. In different African countries certain aromatic plants are used as both aromatherapy and spices (Edwards *et al.*, 2000). However out of large number of aromatic plants and their multipurpose only a few species has been studied in some detail. For example there are about 1500 species of aromatic plants known in the world. From this only 300 or 20% of the species have been studied in detail (Joy *et al.*, 2002).

Aromatic plants' origin, traditional uses and products are as old as agriculture. Starting from early Egyptians, Romans and Greek up to modern age peoples from different parts the world are using aromatic plant for multipurpose. Especially medicinal aromatic plants have been known since ancient time and they are still in use for medicine, cosmetics, perfumery, food, drinks and detergents production (Girma Hailemichael *et al.*, 2008 and Shiferaw Teshome *et al.*, 2016).

Ethiopia is home land and large resources of useful aromatic plants. Spices and perfume plants such as *Cymbopogon citratus*, *Aframomum corrorima*, *Ocimum americanum*, *Juniperus procera*, *Echinops spp.*, *Olea europaea*, *Artemisia spp* and *Cyprus spp* are some of aromatic plants that are indigenous or introduced to Ethiopia and used for different purposes (FAO, (1995).

Plant resources and uses in Ethiopia are still not studied in detail (Reta Regassa, 2013). However; Ethiopian natural environment is known by its natural bio-resources such as different number of herbs, aromatic plants and medicinal plants. Aromatic herbs and spices that are native to the country are available. These plants have diversified traditional uses in Ethiopia. For example

korrerima (*Aframomum corrorima*) which is native to Ethiopia is aromatic herb traditionally used for different purposes such as for spices, medicines and income sources (Guteta Negasu *et al.*, 2016).

1.2 Statement of the problem

In other parts of the world aromatic plants have been identified and reported with their specific numbers and number of uses. For example 1,300 species of plants are identified in India for their aromatics (Devi, 2014). The uses of aromatic plants are reported by some researchers in Ethiopia, for example by Beeminat Mengesha *et al.*, (2010), Eyasu chamo, (2007) and Mesfin Tadesse and Brook Mesfin (2010). However the number of aromatic plants and uses reported are still limited, that need further studies. Despite of aromatic plants are varied and leading source of important products, no study carried out to ensure their availability, multipurpose and sustainable uses in the study area. Therefore this study carried out in Wayu Tuka District to ensure aromatic plants' availability, multipurpose and their sustainable uses. Hence the following research questions were posed.

- What aromatic plants are found in the study area and what ethno botanical background of the plants?
- Is local community using aromatic plants sustainably?
- What are the different traditional uses of aromatic plants among the peoples of the study area?
- What are the parts of aromatic plants used by the local community?
- Which parts of the plant are fragrant and used by the local people?
- Which types of the plants are wild and cultivated?

1.3 Objectives of the study

1.3.1 General objective

To assess traditional utilizations of aromatic plants among the people of Wayu Tuka district.

1.3.2 Specific objectives

- ✓ To assess useful aromatic plants of the study area
- ✓ To assess method of aromatic plants' utilization by people of the study area.
- ✓ To identify parts of the aromatic plants used by the peoples of the study area.

1.4 Significance of the study

So far no research have been carried out on traditional uses of aromatic plants in Wayu Tuka District. This study helps the people of the study area to make more awareness about sustainable utilization of aromatic plants under this consideration. The research finding serves as indicator to the local people by listing the aromatic plant species that are near to extinction, then they can wisely utilize and conserve. Documentation of the plant lists and indigenous knowledge used as source for those want to conduct research on aromatic plants. Accordingly, other stake holders such as surrounding agricultural and forestry institution of the study area focus on the threatened species of aromatic plants make them more sustainable for future uses.

2. Literature review

2.1 Definitions of aromatic plants

Aromatic plants can be defined as those that contain aromatic essential oils that are extracted for perfumery, cosmetics, flavoring, and other human uses. Aromatic plants are often interpreted loosely as culinary herbs. The aromatic plants are those plants that give sweet fragrance or pungent smell due to the presence of odorous volatile compounds in the form of essential oil in one or more parts of the plant and they can belong to family Asteraceae, Apiaceae, Lamiaceae, Rutaceae, Zingiberaceae and etc (Davie, 2014), (Okigbo *et al.*, 2009), (Chandarana *et al.*, 2005).

There is in fact no standard definition of the term 'herb' and the distinction between herbs and spices is an imprecise one. Many aromatic plants are spices, which is any dried substance fragrant, aromatic or pungent vegetables or plant substances in whole, broken or in ground forms that contributes relish or piquancy of foods and beverage (Mathewos Agize, 2014).

Odorous volatile substances of aromatic plants are as essential oil, gum exudates, balsam (cream), oleoresin and spice (Patel, 2014). Spices are essential oils that give foods and beverages flavor, aroma and sometimes color. The term spice refers to any dried plant product used primarily for seasoning, be it the seed, leaves, bark or flowers. They can be marketed whole, ground to a powder or in the form of essential oils and oleoresins. Many spices are also used for other purposes. Plants such as turmeric (*Curcuma longa*) are increasingly in demand for natural therapies, while others such as peppers (*Capsicum* spp.) serve as substitutes for chemical dyes or pesticides (Chandarana *et al.*, 2005). A spice can be also defined as a dried seed, fruit, root, bark or vegetative substance used in nutritionally insignificant quantities as food additive for the purpose of flavoring, and sometimes as a preservative by killing or preventing the growth of harmful bacteria. Many of these substances are also used for other purposes, such as medicine, religious rituals, cosmetics, perfumery or eating as vegetables (Okigbo *et al.*, 2009).

2.2 Historical back ground of aromatic plants study

The aromatic resinous plant exudates, such as frankincense and myrrh, have been treasured for their sacred and ceremonial uses were since long, even before biblical time (Hillson, 1988). People were using plant resources because of their purposive characteristics, there are different reports and ethno botanical evidences that the peoples of African continent and other ancient civilization were using plant resources starting from prehistory. They were using plants as traditional medicines in aromatherapy as well as for other multipurpose and still they are using. Ancient Egyptian writing confirm that herbal medicine have been valued in North Africa for millennia (Okigbo *et al.*, 2009 and Joy *et al.*, 2006).

In ancient civilization such as Egyptians, Romans and Hebrew peoples were using aromatic plants' products for the purposes of religion, rituals, aromatherapy and perfumery. The plants were used to treat different diseases by smelling their aroma found in their different parts. The people were using the plants to heal suffered body and even their soul (Joyet *et al.*, 2006). The production, gathering or cultivation of medicinal aromatic plants is most likely began at or near of the first time of afflictions by smelling, chewing or eating plant materials could provide relief from nausea, pain and other ailments (Thomas *et al.*, 2000). Those plants containing the unique chemical profiles that offered pain relief, pleasant aromas, and enhanced food flavors would soon be renowned and much valued by early humans, leading to associations among certain ailments, plants, and "feeling better". Thus, these plants, now known as medicinal and aromatic plants, and their extracts became the main source for medicines, seasonings, colorings, preservatives, and other similar items used in societies, sustained by myths and traditions developed to explain the almost "magical" powers of selected species and to transmit the accumulation of acquired knowledge before the era of the written records (Craker, 2007).

Aromatic plants have traditionally been used as raw materials for extraction of essential oils. The essential oils eventually used in the flavour and fragrance industries, as well as the sources of spices ,herbs and other natural products such as traditional medicines, pharmaceuticals, cosmetics, insect repellents and herbal tea. Unknowingly or knowingly, people from different parts of the world were using plants products and phytochemicals for these purposes (Joy *et al.* ,2002) and (FAO,2011).

2.3 Aromatic plants in Ethiopia

Ethiopia is known by plants that produce economically important products. Especially oleo gum resin such as gum acacia, frankincense and myrrh are well known in Ethiopia (Ahadu Ayehu and Dawit Abebe, 1993). Ethiopia has amazing biological, ecological and landscape diversity that enable the country to be home land to different biodiversities. The flora of Ethiopia is estimated to be between 6,500 and 7,000 species, of which 10 -12 percent is considered to be endemic .As the result Ethiopia is the most diverse floristic regions in the World (Daniel Kalu and Ali Seid, 2014) and (Ermias Dagne, 2003). Cultivation of aromatic in Ethiopia has remained predominantly traditional over the centuries, being produced mainly by small holder farmers operating on small plot of land around homestead and in natural forests (Goettsch, 1991).

Medicinal aromatic plants are receiving considerable attention all over the world, because of their vast untapped economic potential, especially in the use of herbal medicines. However, uses of MAPs for commercial purposes is not well developed in Ethiopia. It is still in infant stage and medicinal aromatic crops are not well organized. There is no organized cultivation of these plants in Ethiopia (Tamirat *et al.*, 2014).

There are number of indigenous and introduced aromatic plants that can be used for spices and perfumes in Ethiopia. Several important spices which are of Ethiopia origin are *Aframomum corarima*, *Coriandrum sativum*, *Ocimum basilicum*, *Allium cepa*, *Foeniculum vulgare*, *Ruta spp* and *Piper longum*. There are also other aromatic and Perfume Plants used in Ethiopia such as *Commiphora spp.*, *Boswell spp.*, *Cinnamomum cassia*, *Juniperus procera*, *Echinops spp.*, *Olea europaea subsp*, *Otostegia spp.*, *Ocimum spp.*, *Artemisia spp.*, *Cymbopogon citratus*, *Cyprus spp* and *Myrtus communis*. The production and utilization of these groups of plants in Ethiopia is since ancient time (Banjaw, (2016).

2.4 Different purposes of Aromatic plants

In initial usage of plants for purpose of food, medicine, perfume, spices and etc, people can develop great deal of knowledge on various plant species by trials and errors over the years (Chandra, 2015). Aromatic plants are generally referred to as 'natural bio-chemical factories' or 'chemical goldmines'. Not all these natural chemicals can be synthesised in laboratory. Hence they play a valuable and important role in economic, social, cultural and ecological aspects of human lives (Skaria *et al.*, 2006). Medicinal and aromatic plants grow in almost all terrestrial and in aquatic ecosystems around the world. However increasing demand on plants and human exploitation become a great threatening in their indigenous habitation. Several works on aromatic plants in relation to their utilization and conservation have been conducted in different parts of the world (Hey wood, 1999). Aromatherapy; the use of volatile oils for the physical and emotional wellbeing of human is a big industry today and it relies on their knowledge. Essential oils are distilled from different parts of plant such as leaves, bark, roots, flowers, seeds and fruits (Yadav, 2013) and Joy *et al.*, 2001).

Aromatic plants are not only sources of aroma but also used to treat various diseases or disorders. A therapy used for treatment of certain disorder by utilizing aromatic plants is referred to as Aromatherapy. This mode of treatment is as old as human civilization, starting from prehistory (Cetinkaya, 2009).

In different African countries certain aromatic plants are used as both aroma therapy and spices (Mesfin Tadesse and Brook Mesfin, 2010). Many inattentive plants especially aromatic plants are considered as multipurpose and are important to produce valuable substances, essential oils and oleoresins and original aroma useful for agro food, aromatherapy and soap, detergent manufacturing and cosmetics industries (Guteta Negasu *et al.*, 2016).

Aromatic medicinal plants are used for a variety of purposes such as food, primary medicine and drinks. The majority of the world's population, particularly in developing countries, still depends on traditional medicine systems to provide for its primary healthcare needs based on aromatic medicinal plants (WHO, 2002). In developed countries; traditional medicine has also been popular as an alternative treatment system because of the recognition of the benefits of herbal products. In addition, aromatic medicinal plants have been important products for local

communities in developing countries (particularly landless poor people and/or fragile groups such as children and women) to generate cash income to lift their lives out of poverty. These plants are used in a variety of industries such as pharmaceutical, cosmetic, perfume and dyes. Consequently, the values of medicinal aromatic plants for human well-being are very high and therefore the demand for these species has increased on a global level (Cetinkaya, 2009).

Aromatic plants are special group of plants that have long tradition by providing local people with multipurpose (Joy *et al.*, 2005). Medicinal aromatic plants are used in herbal teas, food supplements, liquors, bitters, insecticides, fungicides, and essential oil products, perfumes, flavoring liquids, varnishes, essence and cleaning products. These aromatic plants are widely grown in tropical and sub tropical areas (Joy *et al.*, 2002).

3. Materials and methods

3.1 Descriptions of the study area

3.1.1 Geographical Location

The study was conducted in Wayu Tuka District, East Wollega Zone; Oromia National Regional state. It is situated at (8°56'N - 9°7'N) and (36°32'E - 36°48'E) at about 322 km west of Addis Ababa. The capital town of Wayu Tuka District is known as Gute, found at 12 km east of Nekemte town capital of east Wollega zone. The District's borders are Leka Dulacha in the south, Guto Gida in the west and Sibulire in the northeast (Figure 1). The total area of the district is 40,426.761 hectare with 12 Kebeles, of which 10 rural and 2 urban centers.

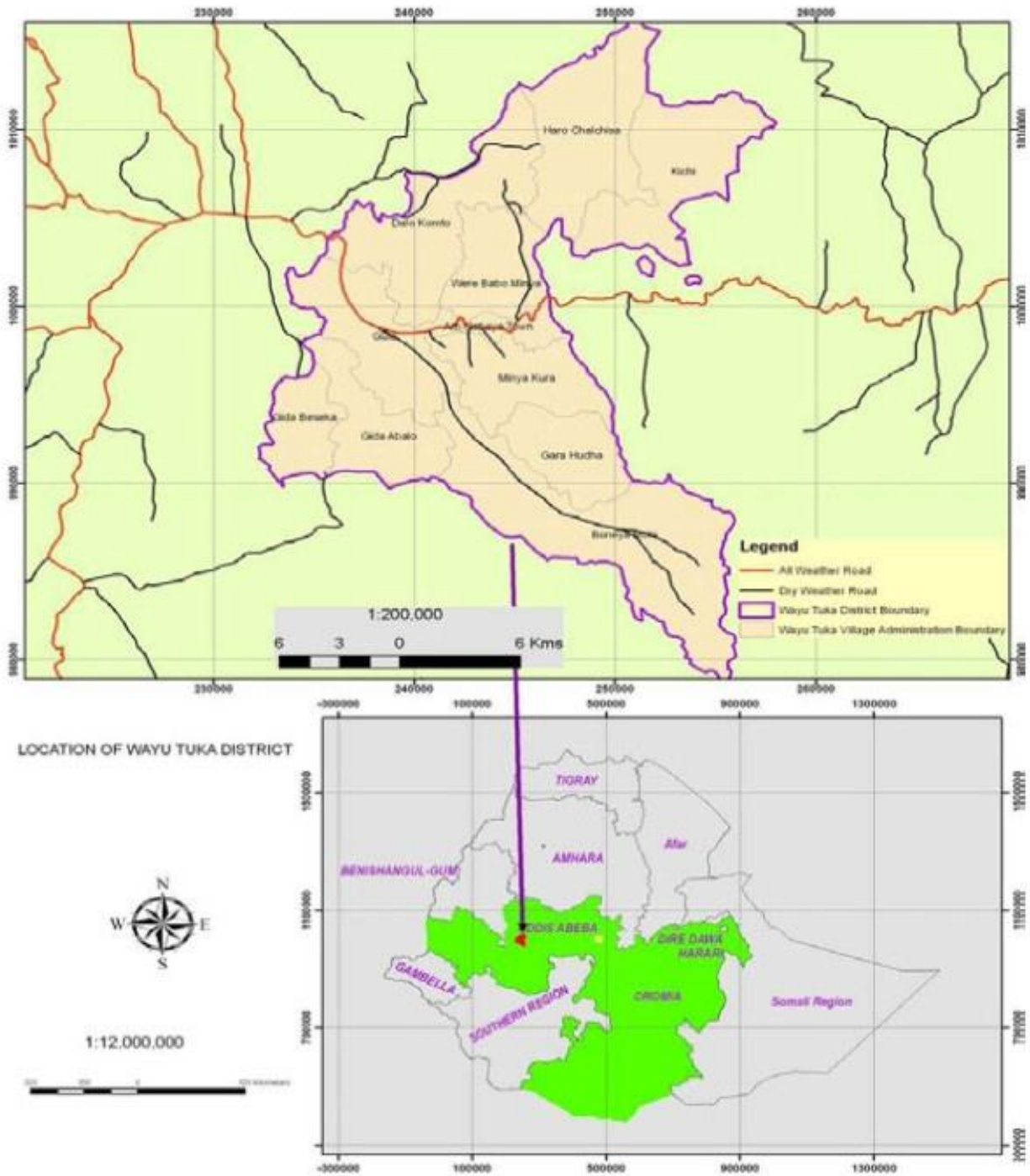


Figure 1: Map of the study area

(Source: Moa Megersa, 2010)

3.1.2 Climate

The study area is classified into three agro climatic regions called high land, midland and lowland locally known as *Baddaa*, *Badda-daree* and *Gammoojjii* respectively. According to National Meteorological Service Agency, concerning climatic and rain fall of the study area from 1998-2000 ,classified in to three. Namely highest rain fall which peaks 2400mm medium which peaks 1600mm and lowest rain fall which peaks 1400 mm.

The rainy season of the study area extends from May to August with the highest peak in June and August in Ethiopian summer. The hottest months of the year in the study area are March and October. In the months February and March highest mean temperature (27.9°C) seen, lowest temperature recorded from December to January (Moa Magersa, 2010).

3.1.3 Land uses

According to the District's work plan report (2017), total area of the Woreda is divided for different purposes farm land, forest, grazing land, construction and other purposes

Table 1: Division of the study area land for different purposes

No	Purposes	Area in hectare
1	Farmland	35735
2	Forest	858.01
3	Grazing land	1309.91
4	Construction	901.56
5	Other purposes	1622.281
	Total	40,426.761

Source: Wayu Tuka district work plan report (2017)

3.2 Sample size Determination and sampling Technique

Survey of the study are was carried out from May 20, 2017 - October 5, 2017 with purposively identification of 5 study sites. The study sites were Bonaya Molo, Dalo komto, Wara Babo Minya, Gaba Jimata and Gute Magala. This study sites were selected because of the plants under this consideration availability based on the District's leaders and knowledgeable people guidance. The population of each study site was 2029, 1908, 1367, 1040 and 1030 respectively which is totally 7381.

The number of sample was determined using sample size determination of proportion of total population which can be determined using the following formula (Daniel, 1999).

$$n = \frac{NZ^2PQ}{D^2(N - 1) + Z^2PQ}$$

Where n=sample size

N= total population of the selected kebeles of the study area (7381)

Z=standard normal variance, with 95%≈1.96

P=Estimated prevalence of population (0.5)

Q=1-p=1-0.5=0.5

D=Error for confidence interval (0.05)

The respondents were 365 from total population of the study sites, 7381

3.3 Respondent selection

From study sites; Bonaya Molo, Dalo komto, Wara Babo Minya, Gaba Jimata and Gute Magala 80,76,72,70 and 67 respondents were randomly taken respectively. This totally become 365 consisting of 318 males and 47 females. Then four (4) key informants were purposively taken from each study sites for further analysis of the cited plant species to carry out different ranking such as preference, direct ranking and paired comparison.

3.4 Data collection of traditional uses of aromatic plants

Identifying of traditional uses of aromatic plants in Wayu Tuka District was carried out to collect aromatic plants used for different purposes from may may 21-26, 2017. First the questionnaires were prepared in English and later translated into Afan Oromo (Official language of the Region). Field observation of each study sites were also carried out. Knowledgeable elders, agricultural workers and volunteer respondents of the study sites were participated in field observation with the researcher. Discussion was purposively carried out with interested groups of respondents from each kebele. Local names, traditional uses, parts of their aroma, the part used, their conservation status whether they are wild or cultivated were recorded during interview and discussion to compare the same information on questionnaire paper. In occasional opposite opinion on the plants, field observations were carried out to the site of specific plant to harmonize them.

3.4.1 Collection of specimens and Identification

Aromatic plants were collected from both home garden and wild areas. First depending on local people knowledge their local names were identified in the field or at study sites. The collected voucher specimens were taken to the herbarium of Jimma University for more identification with the help of professional experts. Published volumes of flora of Ethiopia and Erteria were also used for detail explanations of sample specimens.

3.4.2 Study sites' Field observation and the work Guidance

In any field walk to the study sites interviews and discussion were carried with the core persons provided by the site leaders or part of the woreda's governmental body. The recommended local healers, elders and farmers involved in the field observations, interviews and discussions. The interview questions with questionnaires are almost the same. This uses to ensure the reality of the information given by different respondents. Possible photographs were also taken during field observations (Appendix 4).

3.5 Data Analysis

All the quantitative data gathered about traditional uses of aromatic plants recorded in the study area were entered into Microsoft excel 2007 to summarize and analyze in more notable manner. To summarize the analysis statistical descriptive methods such as Graphs, frequencies, tables and percentages were used in the obtained result. Different rankings such as Preference ranking, direct matrix ranking and paired comparison were also carried out for more analysis.

3.5.1 Preference and direct Matrix ranking

Preference ranking

Preference ranking was carried out following Martin (1995), for 10 total plant species identified depending on their traditional uses by the peoples in the cases of degree of their aroma and medicinal value in which four respondents selected from each study site totally 20 respondents. Each of the 20 respondents provided with 10 plant species to give values 1-5 if the plants used for only spices or medicine and 6-10 if they used for both that, the plant with 1 value is least of the above purposes and 10 is the highest by giving purposes and its aroma. The values summed up and ranked for each selected plants.

Direct matrix ranking

Direct matrix ranking was carried out for 12 multipurpose listed by the respondents of the study area out of 40 plant species identified from each study site. This is to rank the degree of usages of the plants in cosmetics, perfume, spices, food, fumigating, insect repelling, incense, herbal tea, ritual, garden ornament and stimulant. The listed plants provided to the 20 key informants randomly selected and asked to assign best=5, 4=very good, 3=good, 2=less, 1=least and 0=not used. The respondents give the values according to their own perceptions. Then the value of each purpose of each plant summed and ranked. The results were finally summarized using table.

Paired comparison

Paired comparison was carried out to evaluate degree of preference for 10 selected plants in the case of their uses as spices in reference to their aroma and flavoring ability. This is depending on the personal Perceptions of the selected respondents. In this case 12 selected respondents asked to choose the best of their choices of preference items according to their personal perceptions. Their responses were recorded according to Martin,(1995) and summed using the following formula.

$$\frac{n(n - 1)}{2}$$

Where 'n' is the number of aromatic plant being compared and the total possible pairs gained by the formula was 45.

3.6 Ethical issue

Request letter was written from Jimma University to Wayu Tuka Administrative office for the sake of, ethical acceptability and freely giving support. Then ethical letter was written by the wayu Tuka Woreda administrative office to each study sites for the sake of permission and acceptability. Feed back letter was written from the Woreda to Jimma University for reality of data gathering and ethical respecting.

4. Results and Discussions

4.1 Results

4.1.1 Distribution and growth form of aromatic plants in Wayu Tuka District

Wayu Tuka District is included in moist evergreen forest which occurs in south western part of Ethiopia such as Wollega, Ilubabor and Jimma (Moa Megersa, 2010). The vegetation of the area is characterized by both indigenous and exotic plant species. For example plant species such as, *Ekebergia capensis*, *Croton macrostachyus*, *Podocarpus falcatus* and *Prunus africana* are among indigenous group while *Eucalypts* spp are the exotic species in the study area. The plant habits such as tree, shrubs and herbs characterize different plant species of the study area.

From the identified plants 23(57.3%) of them were cultivated aromatic plants, 15(37.5%) of the plants were wild and 2(5%) were both wild and cultivated. By chance most of the aromatic plants identified in the study area were cultivated. This is because of the people cultivate most for these plants for their aromatics, garden ornaments and spices.

How ever the wild aromatic plants identified have more multipurpose than the cultivated plants. The users mostly depend on the plants that were already known as cultivated plants, but they know as the wild one has multipurpose, for example *Lippia adoensis* has the plant with more multipurpose followed by *Olea capensis* from the wild plants. The people are using them for these purposes however they are not cultivated specially, the *Olea capensis* which is the hardest wood of the area and used for incense, fumigator, furniture or construction is near to extinct. According to the elders the plant was many in the area, but currently they are very few in number. On other hand *Aloe vera* is cultivated and very few in number in the study area. It is very aromatic and medicinal plant. Different reports emphasize that the plant is one of the known and useful medicinal plants (Sebsebe Demissew and Inger Nordal, 2010) and (James, 1997). According to one of the key informant, the succulent leaf of the plant is used almost for all diseases however it is not widely used in the study because of limited familiarity with the plant.

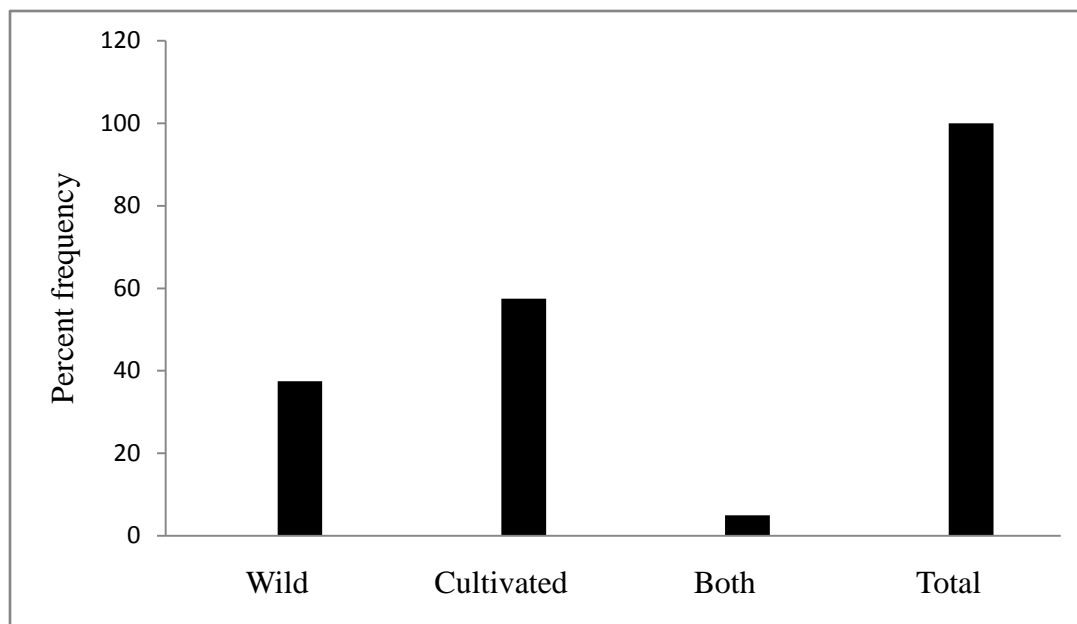


Figure 2: Distribution of aromatic plants in the study area

The planting, collecting, storing and selling processes are just the way they obtain by trial and errors from past generations.

4.1.2 Taxonomic diversity of the identified plants in the study area

In this study, 40 aromatic plant species were identified and recorded. The identified plants categorized under total of 31 genera and 24 families. Among the 24 families Lamiaceae, Rutaceae, Zingiberaceae, Asteraceae, Solanaceae, Verbenaceae, Oleaceae and Alliaceae contain 8 plant species of the identified aromatic plants. Lamiaceae, Rutaceae, Asteraceae and Zingiberaceae contain 6, 4, 3 and 3 different aromatic plant species respectively. Therefore, Lamiaceae represents 15% of the total species; Solanaceae represents 10% while Asteraceae and Zingiberaceae represent 7.5% of the total species equally. The 4 families; Solanaceae, Verbenaceae, Oleaceae and Alliaceae represent 5% of total identified aromatic plants, while each of the other 16 family represents 2.5% of the 40 plant species (Appendix 5). This is summarized on the following graph.

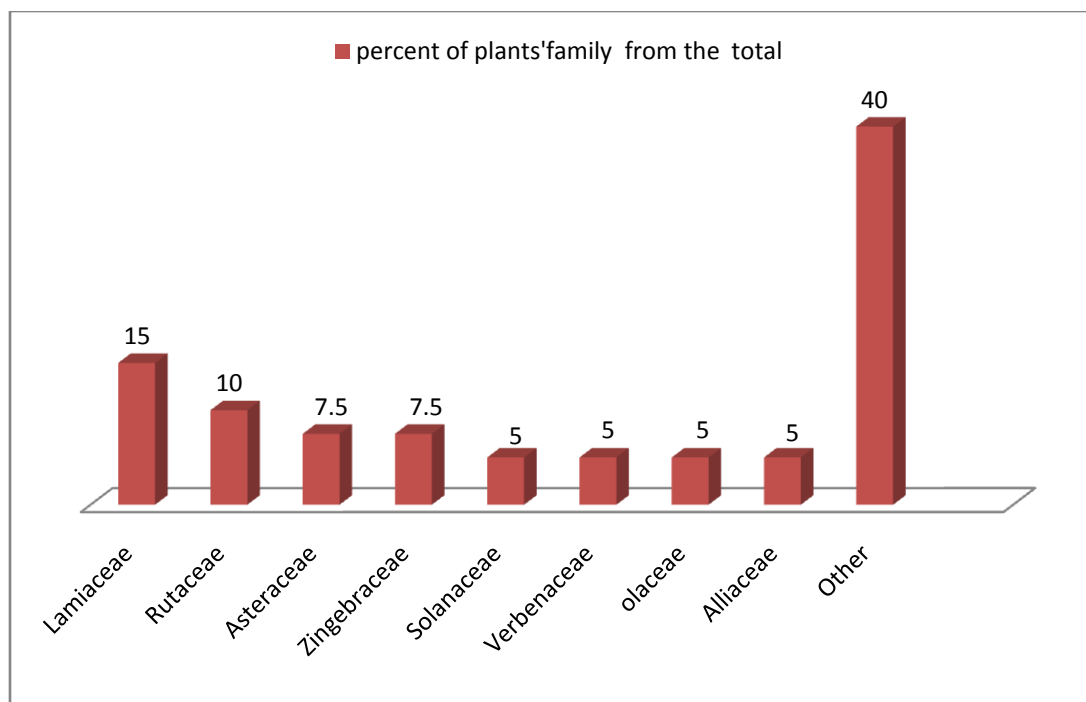


Figure 3: Families of the identified aromatic plants

4.1.3 Respondents' age and their knowledge on aromatic plants

Respondents between 20-40 age group were 234 (64.11%), 41-60 was 98(26.85%) and above 60 was 33(9.04%). The largest number of participants were the youngest group that found in 20-40 (64.11%) age group, this is because of their willingness to participate and ability to give their opinion by writing, and they are found in high educational level group. The total counted different plants in the three age group respondents was 40 and almost all the species are the same plant reported by other groups. Therefore the different plants species found in lists of first age group was 27 which is 67.5%, in the second and third age group the plant lists occurrences were 10(25%) and 3(7.5%) respectively.

From the plants cited by each respondent their local name, their aroma part, the part used and the process of using of each plant was identified. Among the 40 total plant species identified, the male respondents cited 33 (82.5%) out of the total plants. The plant lists by females respondents were most frequently only restricted to those used in cooking and home tools fumigating.

4.1.4 Educational levels of the respondents

From the respondents 18(4.93%) were illiterate, while 169 (46.30%), 104(28.49%) and 74 (20.28) were elementary, high school and college respectively according to the following graph.

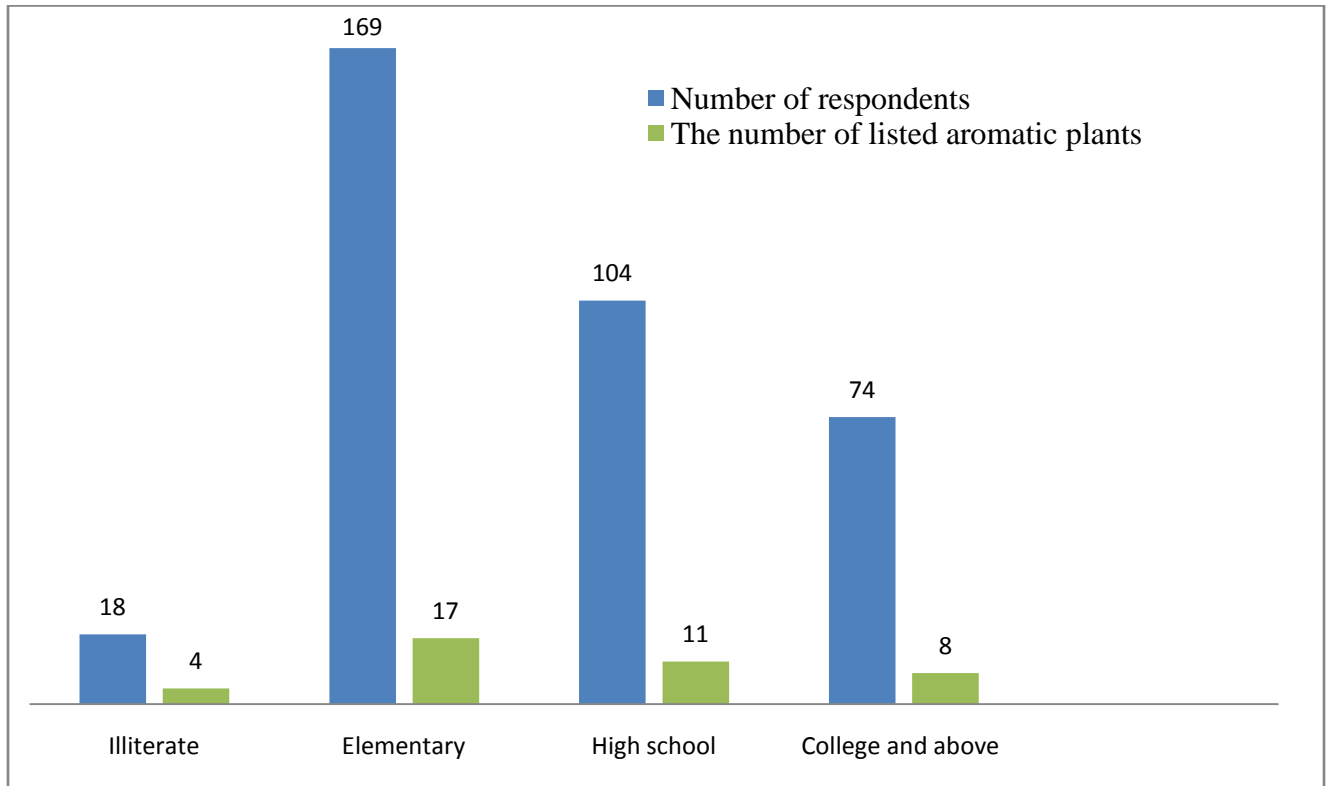


Figure 4: The relationship between Educational status of respondents and aromatic plants

4.1.5 The indigenous knowledge of local people

4.1.5.1 Classification of aromatic plants by the peoples

The peoples of the study area classify the plants depending on their traditional uses, the part of the plants used and the aroma parts of the plants. For example they categorize into spices, stimulants, fumigators, incense and aromatic root by calling in their own language according to the following explanations.

Spices

These groups of aromatic plants include all spices of the study area. The peoples of the study area use these plants in cooking and flavoring foods and drinks. Most of these plants also used for traditional medicines and some of them used for fumigation. Generally, 13 (32.5%) species of the total plants identified were those can be used in spices by the peoples of the study area. The different purposes, the part of aroma and process of using of these plants are summarized in the following table.

Table 2: The aromatic plants used as spices, food, and sauce supplement and medicines

Call No	Local name	Family	Scientific name	The aroma part	Part used	The uses and processes of using
10	Cilaaddama	Rutaceae	<i>Ruta chalepensis</i>	whole plant	Leaf, seed	The fresh leaf used in coffee or tea for stomach ache, the dried seed grinded and used as spices
12	Dimbilaa la	Apiaceae	<i>Coriandrum sativum</i>	Whole part	Leaf, seed	The fresh leaf used in fresh pepper crashed for flavor and food supplement
17	Inshilaala	Apiaceae	<i>F.volgare</i>	Seed, leaf	Seed	The dried and grinded seed used as spices in sauce.
18	Irdii	Zingebra ceae	<i>Curcuma longa</i>	Rhizome	Rhizome	The dried grinded rhizome used as spices almost in all traditional foods, especially in sauce ,bread and injera flavoring
20	Jibinbila	Zingebra ceae	<i>Zingiber officinale</i>	Whole plant	Rhizome	The rhizome is used in fresh or dried and used as spices in many foods and drinks, and known traditional medicine used to treat diseases such as stomach ache and common cold
24	Bassobila a	Lamiacea e	<i>O.Americanu m.</i>	Whole plant	Leaf, seed	The fresh leaf and flower used in flavoring dry products such as yoghurts and milk. It also used to fumigate these product containers

29	Naanayee	Lamiaceae	<i>M. spicata</i>	Whole plant	Leaf	The fresh leaf used as herbal tea (used in tea to drink.
30	Oogiyoo	Zingiberaceae	<i>Aframomum. corrorima</i>	Seed	Seed	The dried and grinded seed used as spices
32	Qullbbii diimaa	Alliaceae	<i>Allium cepa</i>	Whole plant	leaf, Tuber	The fleshy leaf is cooked and used as food; the tuber is known food supplement or spice
3	Qullubbii adii	Alliaceae	<i>Allium sativum</i>	Whole plant	Tuber	The most known aromatic and the tuber is known spices, food supplement traditional medicine used for stomach chaos and common cold, used with many traditional medicines as ingredient.
36	Sunqoo	Fabaceae	<i>Trigonella foenum</i>	Seed	Seed	The dried roasted seed is known spices. It is also known traditional medicines traditionally known as habish to treat stomach ache and gastric
25	Kusaayee	Verbenaceae	<i>Lippia adoensis</i>	Whole part	Leaf	Traditionally to fumigate home and some home tools, the dried leaf also uses as incense in perfuming by burning in home
38	Timaatim	Solanaceae	<i>Lycopersicon esculentum</i>	Whole part	Fruit	The fresh fruit is used as food and food supplement.

Stimulants

Stimulant plants of the study are used after certain processing or by directly chewing the plant parts. Plants such as *Coffea arabica*, *Catha edulis* and *Nicotiana tabacum* are used for these purposes. They give sweet smell after they are processed for certain steps. For example *Coffea arabica*'s seed that is dried is roasted and perfumed in home before used for the commonly known called coffee drink. Those people who are highly addicted to coffee drink use the smell of roasted grain of *Coffea arabica*'s till it reach final stage of drinking.

Catha edulis is used as stimulant, traditional medicine and income generation. The leaf is chewed by some addicted person as stimulant. But currently it is not encouraged by indigenous and religious elders in the study area to chew it because it is highly addictive expose the users to bad habit and extravagancy. The leaf is also used by local healers to treat common cold by boiling the leaf and smelling its smog.

Nicotiana tabacum also used as stimulant traditionally smoked which is currently discouraging by the society. The local healers use it to treat common cold by squeezing the fresh leaf with *Allium sativum* and smelled. Its squeezed juices also used to treat the cow with leech. According to the local healers, when the juices of fresh leaf squeezed of *Nicotiana tabacum* added in to the cow's mouth and nose the leech (*Hirudo medicinalis*) locally known as 'dhulaandhula' dropped out after certain time.

Table 3 : Plant that have certain aroma and considered as stimulant by the local peoples

Call No	Local name	Scientific name	Family	Traditional uses
7	Buna	<i>Coffea arabica</i> L	Rubiaceae	Stimulant, medicine
9	Caatii	<i>Catha edulis</i>	Celastraceae	Stimulant, traditional medicines to treat common cold
37	Tambo	<i>Nicotiana tabacum</i>	Solanaceae	Stimulant, traditional medicines to treat common cold, to treat the cow with leech.

Incenses and smoke fumigator

The plants are mostly aromatic when their certain parts are burning. According to the local peoples these plants are mainly used for two main purposes. They are used for perfuming the home and fumigating the hives or home tools. Their burning smoke applied into hive to attract the honey bee and for disinfection. The plants occasionally used ritually on holly days as perfumes. Plants such as *Olea capensis*, *Terminalia schimperiana* and *Ekebergia capensis* are listed in this group by the local peoples. According to the respondents of the study area *Olea capensis* is the hardest wood of the area and durable used for traditional fence construction in addition to be used for incense and fumigating.

Table 4: Incense Plants of the study area

Call No	Local name	Family	Scientific name	The part used	The uses process and process of using
16	Gajjaa	Oleaceae	<i>Olea capensis</i>	Bark	The bark is aromatic. The dried bark is burned and used for hive fumigating and home perfuming
11	Dabaqqaa	Combretaceae	<i>Terminalia schimperiana</i>	Wood	The dried burning wood is aromatic and used for hive fumigating. Its burning smoke applied into traditional milk container used to prepare butter is to fumigate and disinfect, this is specifically known as “ <i>Muka qoraasumaa</i> ” by the local peoples.
35	somboo	Meliaceae	<i>Ekebergia capensis</i>	Bark	The dried burning bark is aromatic. The burning smoke is applied in hive for honey bee attraction

Fumigator leaf

The local people classify aromatic plants into this group depending on its use and odoriferous part. They call “*Foksituu*” in local language to mean fumigator by fresh leaf /flower is if the plant leaf /whole part is aromatic and used in perfuming and fumigating the home tools, especially liquids such as milk and milk product containers. Fumigating is one of the multipurpose of aromatic plants and it is the process of applying the aroma of the plant to materials for the sake of disinfection and making attractive by perfuming. This usually applied by impressing (rubbing) the fresh leaf to materials. These plants include *Ocimum basilicum*, *Satureja paradoxa* and *Lippia adoensis*. The plant may be found in other group of purpose.

Table 5: Fumigator aromatic plants that the fresh leaves or flowers are used

Local name	Call No	Family	Scientific Name	Method of using
Kefoo	22	Lamiaceae	<i>Ocimum basilicum</i>	Perfumed into traditional milk product containers by impressing the fresh leaf to disinfect and making it to give sweet smell
Kefoo sa'aa	23	Lamiaceae	<i>Satureja paradoxa</i>	Perfumed into traditional milk product containers and traditional hive by impressing the fresh leaf to disinfect and making it to give sweet smell.
Kusaayee	25	Verbenaceae	<i>Lippia adoensis</i>	The fresh leaf used to perfume and disinfect by impressing inside surfaces of hive and different traditional food and drink containers or milk product containers
Bassobilaa	24	Lamiaceae	<i>Ocimum americanum</i>	The fresh leaf and flowers used to perfume milk product containers

Scent plants

Scent plants are used for their sweet smell. The people usually use them when there is a certain unpleasant smell using them for air freshening and also used as the environmental ornaments. Most of these plants are cultivated in home garden and around religious institutions. These plants include *Artemisia afra*, *Cymbopogon citratus* and *Olea europea* that its dried bark and wood used for perfuming in home. *Citrus limon* and *Citrus sinensis* are used in the long journey for their sweet smell rather used to eat. Especially they use *Citrus limon* to prevent nausea caused by unpleasant smell. Some times the leaves of *Lippia adoensis*, *Ocimum americanum* and *Ocimum basilicum* are used for this purpose. However they are not common, most of the times the women of the study area uses these plants to avoid unpleasant odor by sniffing during the air polluted by unnecessary odor.

Aromatic root

Aromatic roots are underground parts of the plant that have fragrant smell and used for different traditional purposes according to indigenous elders and local healers of the study area. These plants are not considered as aromatic when their above ground parts are observed and smelled. Only the indigenous traditional users and local healers know as the roots are aromatic. The people usually use these plants for traditional aromatherapy or for cosmetics.

Table 6: Plants with aromatic root

Call No	Local name	Family	Sc. name	Uses and processes of using
1	Agamsa	Apocynaceae	<i>Carissa spinarum</i>	The underground root is dug out and perfumed to evil eye for its treatment. The dried root bark is burned and smoked to the evil eye to treat.
4	Arangama a gurraacha	Capparaceae	<i>Caparis sepiaria</i>	The dug out underground root is covered by piece of cloth and smelled through the cloth to treat common cold and head ache.
34	Qunnii	Cyperaceae	<i>Cyperus rotundus</i>	The ground anchoring root (rhizome) cut, washed and dried. Then grinded applied to girls' hair with fresh butter as traditional cosmetics.

The people of the study area call the plants if the leaves are aromatic “*kan baalli isaanii urgaa’u*”, and if their barks are fragrant they call” *kan qolli isaanii urgaa’u*” to mean aromatic bark. For example they call *Ocimum urticifolium* as aromatic leaf and *Olea capensis* as aromatic bark. Accordingly they call others as aromatic root and aromatic wood. In the respondents citations there were plants with only one aroma parts they categorize as aromatic plant. However the aroma part identification may be restricted to those are properly familiar with the plants. Any other person who is not familiar with the plant cannot easily recognize as the part of the plant is with certain aroma. For example the Fragrance of *Carissa spinarum*, *Ekebergia capensis* and *Olea europea* are not simply recognized without smelling the root or burning the dried bark and wood of the plants.

4.2 Habits of the aromatic plants identified in the area

The plants in the study area identified for the assessments are fall in to three habit categories called Tree, shrubs and herbs. Among the 40 plants identified, 13(32.5%), 6(15%) and 21(52.5%) are tree, shrubs and herbs respectively. The growth form constitute largest number of aromatic plants in the study area was herbs followed by tree.

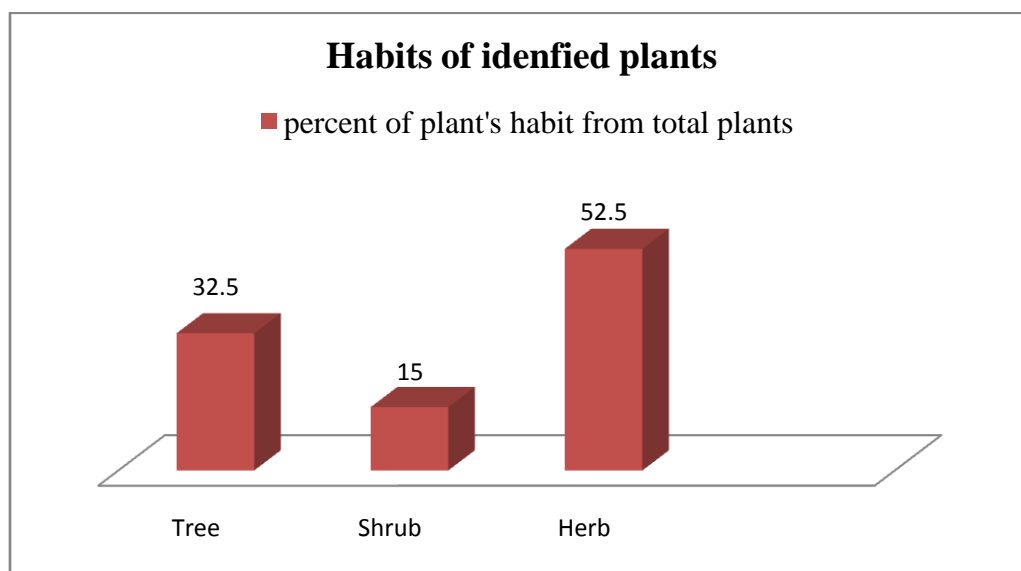


Figure 5: Habits of identified plants in the study area

4.3 Respondents' consensus of total identified plants

4.3.1 The number of aromatic plants reported in each study site

In each study sites the numbers of plants with certain aroma or whole parts reported were 24-38 according to table 10. How ever by rejecting the same plant species repeated in different study sites. only 40 plant species documented for in this study.

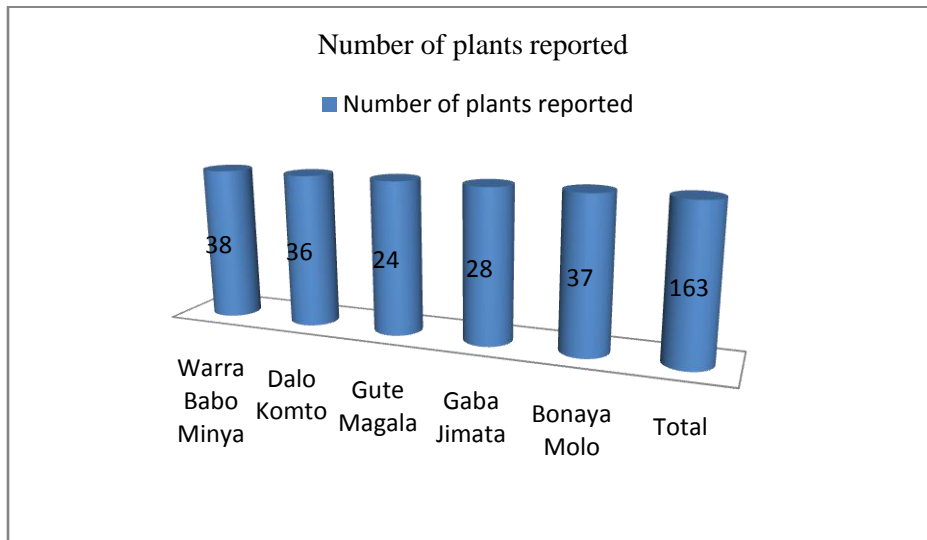


Figure 6: Study sites and number of plants cited.

4.3.2 Aromatic plants cited by largest number of respondents

The number of respondents cited for each of the 40 plants was ranging between 2 and 332. The plants that were cited by a smaller number of respondents are less commonly known in the study area, while the plants cited by many respondents are more commonly known in the study area. Accordingly, the 10 top plants cited by a large number of respondents were identified.

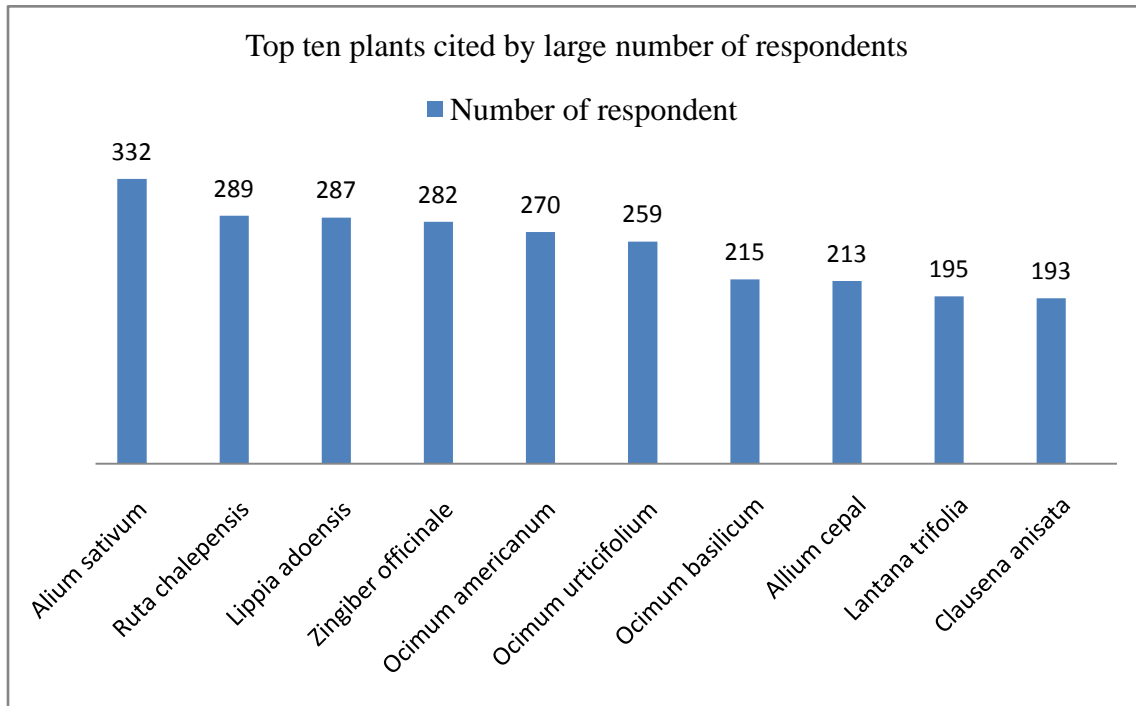


Figure 7: Top ten plants cited by respondents

The plants cited by a large number of respondents show that the plant is more popular and widely used in the study area. Thus, the plant is most popular in the study area. For example, *Allium sativum* is cited by 332 respondents, *Ruta chalepensis* cited by 289 respondents followed by *Lippia adoensis* which is 287. Accordingly, they were ranked up to 10 based on the number of respondents' citation.

4.4 Different purposes of Aromatic plants

All of the plants identified with their certain aroma part or whole plant aroma are used for different purposes by the peoples of Wayu Tuka District. The peoples of study area think that even if they do not know the uses of certain plants specifically they believe that the plant has its own important purposes that have not yet studied. Especially if the plant has unique character they think it may have unique purposes. For example if the plant is odiferous and balsam or resinous they believe it has hidden importance if studied in detail.

The plants identified are used traditionally as cosmetics, perfume/scent, spices, food, fumigator, insect repellent, incense, Ritual, stimulant, garden ornament and herbal tea in addition to medicinal purposes. The other purposes such as stick, construction, teeth brush and furniture are depend on the plants advancement such as having hard wood or advanced stem. Each purpose with specific plant, the part used and processes of using were identified as mentioned above in the classification of the plants by the peoples of study area. According to respondents, perfume, fumigating, incense and ritual are the most purposes of aromatic plants that express good socio cultural relationship between the peoples of the study area. This is because of these purposes are mainly used on holy days and ceremonies of the study area. From the total plants cited 13(32.5%) are used for one purpose. The rest 27(67.5%) are used for 2 or more purposes.

4.4.1 Aromatic woody plants and their purposes

These are the plants that have unique purposes and advanced stem or wood from the other identified plants in the study area. Some of these plants possessing more advanced stem or wood used for purposes such as Fire wood, stick, teeth brush, construction and furniture. These plants include *Coffea arabica*, *Citrus sinensis*, *Citrus limon*, *Catha edulis*, *Terminalia schimperiana*, *Olea europea*, *Juniperus procera*, *Olea capensis*, *Dodonaea angustifolia*, *Mangifera indica*, *Ekebergia capensis* and *Premna schimperi*. There were also plants that are not woody enough but more advanced than the others. These plants include *Ocimum urticifolium*, *Lantana trifolia* and *Ocimum americanum*. Many of these plants have purposes other than the other groups because of their some advancement.

Table 7: Different purposes of Aromatic woody plants from the identified group

Purposes	The plants used in the purposes
Fire wood	<i>Coffea arabica, Terminalia schimperiana, Juniperus procera, Olea capensis, Dodonaea angustifolia, Ekebergia capensis, Premna schimperi, Clausena anisata, and Eucalyptus globulus</i>
Stick	<i>Clausena anisata</i>
Teeth brush	<i>Clausena aniseta, Premna schimperi, Juniperus procera</i>
Construction	<i>Juniperus procera, Ekebergia capensis, Olea capensis and Eucalyptus globulus</i>
Furniture	<i>Olea capensis, Juniperus procera</i>

4.4.2 Ritual plants of the study area

People of the study area have different indigenous knowledge and practice that are related to aromatic plants perspective of their culture and daily life. On holy day and wedding ceremonies they use specific plants that even their local name has its own contextual meaning of indigenous purpose of the plant. For example *Premna schimperi* is one of the identified plants and its local name “*urgeessaa*” meaning making something pleasant in odor or making scent. The people traditionally use its fresh leaf and its young growing part during ceremonies. On marriage both couples take growing *Premna schimperi* leaf to show their good coexistence. The people believe that the plant’s local name has message of having comfortable relationship between each other. The plants’ fresh stick is also used to make local foods such as porridge and “*Buna Qalaa*” which is one of the locally food. The people use *Premna schimperi* for this purpose because they say the plant has no “bitter taste”. The thin fresh stick of *Premna schimperi* is also used as teeth brush. The other aromatic ritual plant in the study area is *Clausena anisata*. The plant’s leaf fresh leaves are used during child birth to perfume the home and the mothers washed with with it. This is because of its good odor and cleanly washing property. During ceremonies such as holy day and after child birth on fifth day the women come together carrying the leaves of *Clausena anisata* locally known as “*ulumaayi*” to express their happiness. They also wash the mother body for the case of cleaning and disinfection. *Juniperus procera* sometimes used as decorating and perfuming around the doors on holy days, there is also some information from the peoples that the burning leaf smoke applied to avoid some insects such as bee when they invading home.

4.4.3 Insects repelling aromatic plants in the study area

Two plant species that are used to control invading ants among the peoples of wayu Tuka District were identified. The local name of one of the identified plant indicates that it used for getting rid of ant. This plant is *Chenopodium ambrosioides* which is locally known as “*Qoricha goondaa*” to mean ants repelling medicine. When the plants ‘fresh leaf applied to invading ants they escape its odor. The other ant repelling plant identified among the peoples was *Tagetes minuta* which is called *barashee/aswiichii* in afan Oromo. The plant’s fresh leaves or dried flowers are applied on invading ant or by brooming the ants’ population to get rid off it.

4.4.4 Medicinal aromatic plants of the study area

Most of the aromatic plants identified in the study area were traditional medicinal aromatic plants. According to the local healers certain aroma parts of each plants has own medicinal purposes. As mentioned in the above classification of the plants by the peoples of the study area the plants ‘aroma found in different parts such as root/tuber or rhizome ,leaf, seed and bark are used to treat ailments traditionally. There are plants that are used to treat certain diseases by smelling the odor. For example the hot boiled shoot leaf of *Eucalyptus globulus*, locally called “*baargamoo adii*” is smelled to treat common cold and head ache. The peoples also use *Citrus limon* fruit by smelling as mentioned earlier to prevent vomiting caused by bad smells. The plants such as *Aloe vera* (Asphodelaceae), *Zingiber officinale* (Zingibraceae) and *Allium sativum* (Alliaceae) are used for medicinal multipurpose of the study area .The roasted grinded grain of *Coffea arabica* used to treat immediate wound by applying on the site to stop the bleeding and they say it make the wounds dry. The people also believe that the powder of roasted *Coffea arabica* applied on wound has disinfecting property. Theye people use the leaf *Ocimum urticifolium* to treat head each by squeezing the leaf and apply the drop into the ear with drop of water. It has morphological similarity with *Lantana trifolia* called kasee in local name. But *Lantana trifolia* is not as highly aromatic as *Ocimum urticifolium*. According to the local healers they have similar medicinal value; however the *Lantana trifolia* is more commonly known aromatic medicinal plants than *Ocimum urticifolium*

Aloe Vera which is called “*harkisa*”in afan Oromo is very limited in the study area .It is only cultivated in elementary school of konchi which is found in Gaba Jimata study site.

Generally, from 40 aromatic plants identified, 19(47.5%) of them are used to treat humans and lives stock ailments (Table 8).

Table 8: Medicinal aromatic plants in the study area

Local name	Scientific name	Call No	Medicinal uses description
Agamsa	<i>Carissa spinarum</i> L	1	The root is very Aromatic and it is used to treat people with evil eye .The dried root bark is burned and smoked to evil eye.
Harkisa	<i>Aloe vera</i>	2	The leaf succulent is aromatic and it is used for different diseases such as head ache, the leaves used for inflammation, tumor, ulcer, burns, boils, cuts and wounds by applying the leaf pulp on the scalp and rubs it well.
Ancabbii	<i>Ocimum urticifolium</i>	3	Fresh leaf is squeezed and smelled or the juices with drop of water dropped through ear for head ache caused by un well traditionally called michii in local language
Arangamaa gurraacha	<i>Caparis sepiaria</i>	4	Its aromatic root is dried , grinded and Smelled (sniffed) tying in piece of clothfo for a minute to treat head ache and common cold.
Baargamoo adii	<i>Eucalyptus globulus</i>	5	The shoot is very aromatic and used for head ache and common cold by applying the boiled shoot and the emitted gas from the boil is smoked
Buna	<i>Coffea arabica</i>	7	The roasted and crushed grain is applied on immediate wounds to stop bleeding and making it dry
Caatii	<i>Catha edulis</i>	9	The shoot is boiled and used to treat head ache and common cold by applying the boiled shoot and the emitted gas from the boil is smoked.
Cilaaddama	<i>Ruta chalepensis</i>	10	The leaf, shoot and seed used to treat stomach ache by eating with garlic (<i>Allim sativum</i>) and Zigiber(<i>Zingiber officinale</i>) .Its fresh leaf is some times used in coffee and tea for these purposes,as well as flovouring
Ittacha	<i>Dodonoea angustifolia</i>	19	The people traditionally wash the animals such as calf and bull to avoid flea that can harm the animals by using the

			fresh leaf with water
Jibinbila	<i>Zingiber officinale</i>	20	Rhizome as medicine to treat stomach ache, common cold by eating with food and with tea, it is very common.
Kasee	<i>Lantana trifolia</i>	21	Its leaf is known medicinal aromatic plant to treat head ache by squeezing and applying the smell through nose(smelling) Used to treat coughs and colds, the fresh leaves are squeezed and the juice sniffed
Qullubbii adii	<i>Allium sativum</i>	23	The tuber has known medicinal uses used to treat stomach ache, common cold eaten with food or boiled with tea usually with <i>Zingiber officinale</i>
Loomii	<i>Citrus limon</i>	26	Its juice uses as medicine for stomach ache traditionally people uses with traditional ethanol(Areke) to treat internal stomach ache called “garaa ciniinnaa “.Traditionally the peoples use to prevent vomiting on the long journey by smelling the fruits odor
Marga citaa	<i>Cymbopogon citratus</i>	28	It has medicinal value for stomach problem the root cleaned cut into pieces is eaten with garlic(<i>Allium sativum</i>)
Sunqoo	<i>Ekebergia capensis</i>	36	Its dried seed roasted is aromatic and almost applied to all food as spices. It is used as medicine for stomach problem such as gastric
Tamboo	<i>Nicotina Tabacum</i>	37	Used to treat cow with leech. The fresh leaf squeezed and the juices dropped into cup applied in to the cows nose to treat blood sucker annelid called leech(<i>Hirudo medicinalis</i>) and in afan Oromo ‘dhulandhula’ then the organism come out
Ulumaayi	<i>Clausena anisata</i>	39	The leaf uses to avoid chicken eater fleas. The chicken is washed by fresh leaf of <i>Clausena anisata</i> with water to avoid the fleas. The fruit are edible and used to treat stomach ache and gastric. But its fruit is usually not seen, it stay long without bearing fruit.
Urgeessaa	<i>Premna schimperii</i>	40	The growing shoot stick used to minimize tooth ache by applying on the site of pain.

4.4.5 Parts aromatic plants used for different purposes in the study area

The parts of plants identified commonly used for multipurpose are bark, root, bulb, wood, rhizome, leaf and seed. Parts of the plants used for different purposes were usually the parts known by their aroma. The plants with aromatic roots and those their aroma is recognized only after certain process. During burning and squeezing barks, wood or leaves of some plants their aroma is more recognized by smell detection. The aroma of aromatic root is detected only after dug out from under ground. The aroma of some of the identified plants in the study area properly recognized during burning their certain parts. For example the burning bark of *Ekebergia capensis*, wood of *Olea europea*, wood of *Terminalia schimperiana* and roasting seeds of *Coffea arabica* have odoriferous smell from their immediate smoke when they are burning.

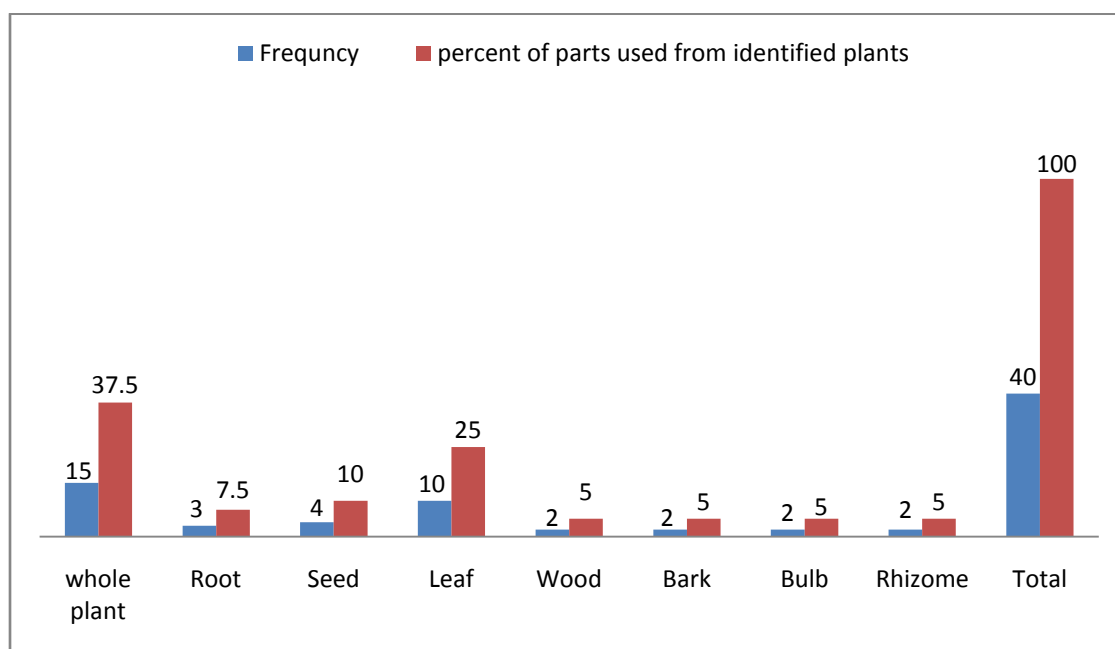


Figure 8: Parts of the aromatic plants used for multipurpose in the study area

4.4.6 Comparison between each plant depending on their purposes

From the total investigated plants 6(15%) of them, *Carissa spinarum*, *Aloe vera*, *Ocimum urticifolium*, *Dodonoea angustifolia*, *Lantana trifolia* and *Caparis sepiaria* are used for only medicinal purpose. *Ruta chalepensis*, *Zingiber officinale*, *Allium sativum* and *Tringonella foenum* which are 4(10%) of the identified plants are used for medicine and spices. *Aframomum*

corrorima, *Coriandrum sativum*, *Foeniculum vulgare* and *Curcuma longa* with same number and percent4 (10%) are used for only spices. *Tagetes minuta* and *Chenopodium ambrosioides* are used for only in insect repellents. *Coffea arabica* and *Catha edulis* are used for both stimulant and medicinal purposes. *Allium cepa* and *Lycopersicon esculentum* are used for both as food and spices. *Olea europea* and *Olea capensis* are used incense and fumigating, *Ekebergia capensis* and *Terminalia schimperiana* are used for fumigating and fire wood. *Lippia adoensis* the plant used for spices, fumigating, perfume fire wood and incense. *Clausena anisata* and *Premna schimperi* are used for rituals, teeth brush, fire wood and medicines. *Olea capensis* used for fumigating, furniture, constriction and incense. *Ruta chalepensis* is used for spices, medicine and herbal tea. *Mentha spicata* is used for only herbal tea. *Cyperus rotundus* is for only cosmetics, *Citrus limon* is for both perfume and medicine. *Cymbopogon citratus* is used for perfume, medicine and home garden ornament. *Artemisia afra* is used for cosmetics, perfume and home garden ornament. From the general 17 purposes identified, they were categorized into 25 depending on their individual multipurpose to investigate whether the plant is used for one or more purposes.

Table 9: Multipurpose of aromatic plants in the study area

No	Purposes	Frequency of the plant for the purposes	% of total plants
1	Medicine, fire wood and construction	1	2.5
2	Medicine ,perfume	1	2.5
3	Medicine, garden ornament, perfume	1	2.5
4	Perfume, garden ornament and cosmetics	1	2.5
5	Food and perfume	1	2.5
6	Spice, medicine and herbal tea	1	2.5
7	Ritual, medicine, stick and teeth brush	1	2.5
8	Stimulant and medicine	3	7.5
9	Only food	1	2.5
10	Perfume, fumigator and spice	2	5.0
11	Ritual, medicine, fire wood, teeth brush ,construction	1	2.5
12	Food and spice	2	5.0
13	Only spices	4	10.0
14	Medicine and spice	3	7.5
15	Only medicine	5	12.5
16	Insect repellent and ritual	1	2.5
17	Fumigators ,incense and garden ornament	1	2.5
18	Ritual and fumigator	1	2.5
19	Only cosmetics	1	2.5
20	Only herbal tea	1	2.5
21	Only insect repellent	2	5.0
22	Fumigator and fire wood	2	5.0
23	Incense, construction, furniture and fumigator	1	2.5
24	Fumigation, perfume, incense, fire wood	1	2.5
25	Medicine and construction	1	2.5
	Total	40	100.0

It is possible compare the plants by counting the number of indigenous multipurpose. For example *Premna schimperi* and *Olea capansis* stood first by using for five multipurpose. *Lippia adoensis* is used for fumigator, perfume, incense and some times for fire wood. It is one of the three plants species stood second by using for four multipurpose among aromatic plants identified in the study area. *Artemisia afra* is used for Cosmetics, perfume and home garden ornament. The nine top plant species by counting their multipurpose from the listed aromatic plants of the study area was identified and summarized as in the following table.

Table 10 : The top 9 aromatic plants with multipurpose of the study area

Plant spe Cies	Number multipurpose	multipurpose Purpose
<i>Lippia adoensis</i>	4	Fumigation,perfume, incense, sometimes fire wood
<i>Premna schimperi</i>	5	Medicine,ritual,teeth brush,construction,fire wood
<i>Olea capansis</i>	5	Incense,fumigation,furniture, fire wood construction,
<i>Clausena aniseta</i>	4	Stick,medicine,ritual,teeth brush,
<i>Ocimum basilicum</i>	4	Spice,perfume,fumigate,garden ornament
<i>Ruta chalepensis</i>	3	Herbal tea,medicine,spice
<i>Ocimum americanum</i>	3	Spice,fumigator,perfume
<i>Artemisia afra</i>	3	Perfume,cosmetics,garden ornament
<i>Cymbopogon citratus</i>	3	Garden ornament, perfume ,medicine

4.5 Ranking of the aromatic plants in the study area

Result of Preference ranking

Allium sativum stood first, *Zingiber officinale* and *Lippia adoensis* 2nd and 3rd respectively. *Ocimum americanum*, *Coriandrum sativum*, *Ocimum urticifolium*, *Olea capensis* and *Clausena aniseta* stood 4th, 5th, 6th, 7th and 8th respectively. *Lantana trifolia* and *Carissa spinarum* were get the last two ranks stood 9th and 10th Respectively (Table 11).

Table 11 : Result of Preference ranking

The selected plants.	The selected respondents(R ₁ .R ₂₀)																				Total	Rank
	R ₁	R ₂	R ₃	R ₄	R ₅	R ₆	R ₇	R ₈	R ₉	R ₁₀	R ₁₁	R ₁₂	R ₁₃	R ₁₄	R ₁₅	R ₁₆	R ₁₇	R ₁₈	R ₁₉	R ₂₀		
<i>O.curticifoliam</i>	4	4	3	5	5	3	2	4	3	5	5	5	5	2	3	5	3	4	4	5	79	6 th
<i>Lippia trifolia</i>	3	2	1	2	3	4	4	2	3	3	3	4	3	4	5	5	5	3	2	3	64	9 th
<i>Carissa spinarum</i>	2	1	1	3	3	2	3	4	3	3	5	2	2	2	3	3	3	3	4	4	56	10 th
<i>Ocimum americanum</i>	5	5	5	4	5	5	5	5	5	5	4	4	5	5	5	5	5	5	5	4	116	4 th
<i>Allium sativum</i>	6	7	6	6	7	10	10	8	8	7	8	7	7	7	8	10	10	6	7	7	152	1 st
<i>Zingiber officinale</i>	6	6	6	7	7	9	9	6	6	6	8	6	6	6	7	10	10	9	6	6	144	2 nd
<i>Coriandrum sativum</i>	2	4	5	5	5	4	3	3	3	4	5	5	5	4	3	3	5	5	5	4	84	5 th
<i>Lippia Adoensis</i>	6	6	6	7	6	6	8	6	6	6	7	6	6	7	6	6	8	8	7	7	131	3 rd
<i>Olea cepansis</i>	4	4	3	4	3	3	5	5	3	1	2	4	3	5	5	4	4	3	4	3	72	7 th
<i>Clausena aniseta</i>	5	4	5	2	3	4	5	5	5	5	3	2	3	4	4	2	2	3	4	2	70	8 th

Direct matrix ranking

Depending on the personal assumption of the key respondents, according to results of direct matrix *Olea cepansis* 1st, *Lippia adoensis* 2nd, *Ocimum basilicum* 3rd, *Premna schimperi* 4th, *Ocimum americanum* 5th, *Clausena anisata* and *Cymbopogon citratus* were booth stood. 6th, *Ruta chalepensis*, *Allium sativum* and *Artemisia afra* were stood 8th, 9th and 10th, respectively (Table 12).

Table 12: Direct matrix ranking result

Selected plants		Garden.	Ornament	Medicine	spices,	Fumigating	Teeth	Perfume	Incense	Fire wood	Furniture	Constructi on	Total	Rank
1	<i>Ocimum basilicum</i>	3	0	5	4	0	5	0	0	0	0	0	17	3 rd
2	<i>Lippia adoensis</i>	0	0	5	5	0	5	4	4	4	0	0	23	2 nd
3	<i>Olea capansis</i>	0	0	0	5	0	4	4	4	5	4	5	27	1 st
4	<i>Allium sativum</i>	0	5	5	0	0	0	0	0	0	0	0	10	9 th
5	<i>Ruta chalepensis</i>	3	3	5	0	0	0	0	0	0	0	0	11	8 th
6	<i>Premna schimperi</i>	0	4	0	0	4	0	0	0	4	0	4	16	4 th
7	<i>Artemisia afra</i>	2	0	0	0	0	5	0	0	0	0	0	7	10 th
8	<i>Ocimum americanum</i>	2	0	5	3	0	5	0	0	0	0	0	15	5 th
9	<i>Clausena.anis ata</i>	0	5	0	0	4	0	0	0	3	0	0	12	6 th
10	<i>Cymbopogon citratus</i>	3	4	0	0	0	5	0	0	0	0	0	12	6 th

Paired and comparison

According to Results of Paired followed by Martin, 1995; *Lippia adoensis* and *Allium sativum* were both stood first. *Ocimum americanum* and *Ocimum basilicum* stood 2nd and 3rd respectively followed by *curcuma Longa* and *Zingiber officinale* which were stood 4th and 5th respectively. *Allium cepa*, *Coriandrum sativum*, *Ruta chalepensis* and *Foeniculum vulgare* were stood 6th, 7th, 8th, and 9th respectively (Table 13).

Table 13: Results of Paired comparison for the selected plants

Aromatic plants used	R ₁	R ₂	R ₃	R ₄	R ₅	R ₆	R ₇	R ₈	R ₉	R ₁₀	R ₁₁	R ₁₂	Total	Rank
<i>Lippia adoensis</i>	2	5	5	5	4	3	4	6	5	7	3	5	54	1 st
<i>Ocimum basilicum</i>	2	4	4	4	4	5	5	4	3	5	4	5	49	3 rd
<i>Ocimum americanum</i>	4	5	4	4	6	5	5	6	5	2	3	1	50	2 nd
<i>Allium sativum</i>	5	5	5	5	6	5	5	5	3	4	5	1	54	1 st
<i>Zingiber officinale</i>	3	4	5	4	5	5	5	4	3	3	3	3	46	5 th
<i>Coriandrum sativum</i>	2	5	5	2	1	1	1	1	4	4	2	2	30	7 th
<i>Allium cepa</i>	5	5	5	0	5	5	0	5	5	5	1	4	45	6 th
<i>Ruta chalepensis</i> L	5	0	4	4	1	4	0	3	3	4	1	3	29	8 th
<i>Curcuma longa</i>	0	5	5	5	5	5	5	5	0	5	4	3	47	4 th
<i>Foeniculum vulgare</i>	0	3	2	0	2	1	0	1	0	2	5	2	18	9 th

4.6. Discussion

4.6.1 Spices cultivation of the study area

Most peoples of the study area are farmers and their lives depend on domestic animals breeding and farming. There are common crops and spices mainly cultivated in the study area. *Eragrostis teff*, *Guizotia abyssinica* (oil crop), *Hordium vulgare*, *Pisum sativum*, *Sorghum bicolor*, *Vicia saba*, *Zea mays* and *Eleusine coracana* are among the crops widely farmed in the study area. The spices such as *Aframomum corrorima*, *Curcuma longa*, *Zingiber officianale* and *Coriandrum sativum* are also cultivated. Similar findings were reported by (Moa Megarsa, 2010).

4.6.2 Natures and aroma parts of the plants used in the study area

If a certain plant part is odoriferous, it is aromatic plant. It may seem that fragrance of a plant restricted to the part that is easily observable and able to be smelled from leaf or from any other external plant part. However the aroma of a plant can be found in root and in barks when burnt. There were many plants that are whole plant aromatic. The knowledge of indigenous peoples of the study area confirm this issue that they call the plants ‘aromatic’ even if it has certain fragrant smell in only one part. Therefore the plant is aromatic when certain fragrance is found in one or more part of the plant. This is concurring with the reports of findings by Joy *et al.*, (2002), Patel (2015) and FAO (2012).

Aromatic plants are the leading source of spice, oils, perfume, cosmetics and other industrial phytochemicals because of their special aroma producing nature. Hence ;the saying of that “aromatic plants are generally referred to as ‘natural bio-chemical factories’ or ‘chemical goldmines’” is appreciable (Joy *et al.*, 2006).

However some of the plants fragrance is recognized after certain traditional processes. For example the fragrance of *Olea europea*, *Coffea arabica*, *Ekebergia capensis*, *Terminalia schimperiana* and *Tringonella foenum* are only recognized properly during certain burning processes. Burning bark of *Ekebergia capensis* gives sweet smell smoke that is used in hive fumigating and perfuming for honey bee attraction. Similarly the burning *Terminalia schimperiana* ‘dried wood give sweet odor and used for fumigating or perfuming hive and traditional milk product containers. The identified plants categorized by the peoples of the study

area into aromatic root, aromatic leaf, aromatic bark and the whole plant aromatic is harmony with Joy *et al.*, (2002), because of the plant is said to be aromatic if it possesses odorous volatile substance in one or more parts such as root, bark, wood, leaf or any other parts according to the report. Therefore aromas of the identified plants were found in root, seed, leaf, wood, bark, bulb, succulent leaf and rhizome. When the aroma parts of the identified plants in the study area compared with each other whole plant stood first which was 15(37.5%) from 40 plant species, leaf stood second containing 9(22.5%) plant species from the whole identified followed by seed which constitute 4(10%) plant species.

If the plant root is aromatic, the root is used for specific purposes. This because; the aromatic plants' traditional uses are based on their aroma contents. For example *Carissa spinarum* root is aromatic and only the root is used to treat the person for evil eye. The plants leaf or other part is not aromatic, therefore no other part of *Carissa spinarum* is used for this purpose except its root. Other example in the case of *Olea capansis* only its bark is aromatic, thus only its bark is used for hive fumigating and incense because of its aroma. Only the purposes such as furniture, fire wood, construction and teeth brush are usually not depend on the plants aroma part according to the information gained from the peoples of study area. This is because of the other non-aromatic plants often used for these purposes.

4.6.3 Different purposes of aromatic plants in the study area

The identified plants used for medicine ,spice ,food, fumigator, incense, perfume, cosmetics, garden ornament, fire wood, furniture, teeth brush, construction, stick, ritual, stimulant and herbal tea as mentioned above in different sections. Similar findings were reported by (Guteta Negasu *et al.*, (2016).The plant purposes for fire wood, teeth brush, stick, furniture and constructions are not for their constituent of certain aroma because any other plants can be usually used for these purposes.

The finding of this study agrees with Gemedo Dalle, (2004) that the traditional knowledge and use of wild plants are wide spread. It emphasizes that the rich biological diversities and indigenous knowledge of these diversities are not adequately documented.

Indigenous people and priest were using aromatic plants in church or for other religion ceremonies (holy day) and they are currently using these plants. These are the plants mentioned

under ritual purposes in this study. Similarly Mulugeta Lemenih and Demel Teketay, (2000) reported that fragrant oleo-gum resins are the oldest prescriptions (about 1500 B.C) that priests were using to treat wounds and they were using for funerals, mummification and cremations. These applications of aromatic plants are correspondingly using for multipurpose in different parts of the world.

4.6.4 Aromatic Medicinal plants of the study area

Most of the identified plants were those used for traditional medicines in the study area. From the total plants 18 (45%) plant species were those can be used for traditional medicinal purposes. Among these plants 7 (17.5%) of them are used for only medicinal purposes. The People of the study area use aromatherapy which is treating any disorder using certain aroma of the plants. This mode of disorder treatment is mostly carried without further processes. They benefited through food, incense or ritual healing. The similar finding was reported by FAO, (2012). The odor of the plant may simply sniffed through nose. For example the *Carissa spinarum*'s root dried burning smoke sniffed to treat evil eye. The root aroma of *Caparis sepiaria* also sniffed through clean cloth to treat head ache and common cold. The peoples of the study area have knowledge on medicinal value of the identified plants most of these medicinal aromatic plants were cited by the participants except 4 plants; *Caparis sepiaria*, *Aloe vera*, *Dodonoea angustifolia* and *Premna schimperi* that were not reported in some study sites. Even any indigenous people that are not local healers know the plants as they are used in treating certain disorder. This shows the peoples properly their plants especially how to uses medicinal plants. This study agrees with finding of Moa Megersa, (2010) on Ethnobotanical study of the area that the peoples have deep knowledge about their surroundings. However in the Ethnobotanical study of the area (Moa Megersa, 2010) no report found about the aromatic plants of the study area.

Allium sativum is the most frequently reported medicinal aromatic plants of the study area followed by *Ruta chalepensis*, *Zingiber officinale* and *Ocimum urticifolium* respectively. This indicates that these plants are the most popular in their medicinal value and in their fragrance. These plants are the whole sweet smell plants except *Ocimum urticifolium* which is aromatic leaf. The high frequent citation number of these plants is not only in the case of their medicinal value. The respondents also consider their fragrance in addition to their medicinal value because the questioners prepared for them were mostly focus on the plants aroma. Therefore there were plants

that have more medicinal value and less frequency of citation. For example *Lantana trifolia* and *Ocimum urticifolium* are medicinal aromatic plants that are much similar and used to treat the same diseases, fibril illness locally known as “*michii*” and head locally known as “*mataa bowwuu*” even the processes of using are the same. However they cited by the respondents much differently. According to the local healers *Lantana trifolia* (kasee in local name) has more power full in healing and has more medicinal value than *Ocimum urticifolium* (Ancabbii in local name). However the fragrance of *Lantana trifolia* is much less than that of *Ocimum urticifolium*. Odor of *Lantana trifolia* is not very sweet. Therefore it is cited less frequently than *Ocimum urticifolium*. Similar findings of medicinal value aromatic plants listed in this study were reported Moa Magersa, (2010). However no finding was reported concerning the similarities and differences of *Ocimum urticifolium* and *Lantana trifolia* the case of their aroma and aroma parts.

The aromatic plants in the study area could be applied for medicinal uses easily by smelling or applying their squeezed liquid aroma to wash in mouth and other infected parts. Similar findings reported by Joy *et al.*, (2001) that for therapeutic purpose, aromatic plants are administered as inhalation, oral intake, massages, gargles and mouth wash.

4.6.5 The plants mostly used for multipurpose in the study area

Most of the identified plants were those with two or more multipurpose. These multipurpose are mainly due to their certain unique odiferous nature recognized in their one or more parts such as leaf, bark, seed or other underground parts,. This concept agrees with the report of (Okigbo *et al.*, 2009) that the phytochemicals found in different parts of medicinal aromatic plants enable them to use for curative agent and insect repellents. Depending on their number of multipurpose top aromatic plants that are used 3-5 multipurpose were identified in the study area. These plants are listed and explained according to their rank in multipurpose as follow.

1. *Lippia adoensis* (kusaayee in local language)

Lippia adoensis is one of the known aromatic plants in the study area belonging to Verbenaceae family. The plant is good example of aromatic plants known by its pleasant odor in the study area. The peoples of the study area use the plant for fumigation, perfuming, and incense and sometimes as fire wood. The finding of Anwar Endris *et al.*, (2015) emphasized that *Lippia* belongs to Verbenaceae family comprising about 200 herbs, shrubs and small trees which are often aromatic in nature. It also underlined that, there are five *lippia* species found in Ethiopia. These species are; *Lippia adoensis*, *Lippia Abyssinica*, *Lippia dauensis*, *Lippia carviadora* and *Lippia javanica*. Hence, *Lippia adoensis* is one of the five *Lippea* species found in Ethiopia. There is no information about the traditional medicinal value of *Lippia Adoensis* in the study area. However reports of Anwar Endris *et al.*, (2015) shows that the *Lippia* species of Ethiopia have medicinal values.

2. *Oleacapsis* (Gajjaa in local language)

According to Azene Bekele (2007), the plant is 10–20 m long which straight trunk does best in good forest soil, but hardy drought resistant once established even in poor soil. Fruit does not produce oil. This plant is thus one of the medium sized tree belong to the family Oleaceae. Similar finding was reported according to Green, (1952) that the plant is very similar with *Olea europea*. No report found about the plant's Ethnobotany in Ethnobotanical study of similar area by Moa Megarsa, (2010).

Olea capsis one of aromatic bark identified in this study. Its bark aroma is recognized without further processes, it is just perfumed as the bark is taken from the stem. However it is highly aromatic when dried and burning. For this reason the people use it as incense and hive fumigating and perfuming to attract honey bee. The people of the study area use it for incense; hive fumigating, furniture, fire wood and construction. This finding agrees with report of Azene Bekele, (2007) its bark has a medicinal value that is not known in the study area. The people of the study area confirm that, the plant is the hardest tree to cut its matured stem, especially they emphasize that *Olea capsis* bends their axes when they try to cut its matured dried stem. From this they conclude that it is the hardest tree of the area from the wild.

Olea capansis in the study area is very rare, practically the plant was seen in only Wara Babo Minya kebeles during the study site field observation, it is one the plant near to extinction because of deforestation according to the indigenous elders of the study area, it is in threaten status to be endangered.

3. *Premna schimperi* (Urgeessaa in local language)

Premna schimperi is small spreading shrub or tree up to 5–7 m long. Young branchlets are densely hairy. Its leaves are opposite, simple, the edge toothed, broadly ovate and aromatic (Azene Bekele, 2007). According to Kabra *et al.*, (2015), the genus *Premna* contains 200 species under the family Verbanaceae and from these leaves of *Premna schimperi* are used to treat leishmaniasis. This shows that the plant has medicinal value. Similarly *Premna schimperi* has traditional medicinal value in the study area that the peoples use its young shoot to treat tooth ache by applying on the pain. The plant is also the known ritual plant in the study area. *Premna schimperi* is also one of the plants reported with largest number of multipurpose in addition to medicinal and ritual value. It is used for construction, teeth brush, and fire wood in the study area.

The plant is traditionally very beloved that it has normal odor and no bitter taste according to the peoples' assumptions of the study area. Its afan Oromo name “*Urgeessaa*” has the plant's odoriferous contextual meaning. Sometimes name of persons in study area are given by the plant's name, ‘*Urgeessaa*’ means “flavoring or giving pleasant odor”. It is believed that the plant has sign of love between individuals especially between the couples when they are getting married. The peoples also use the plant to stir some traditional cooking foods, such as porridge and “*Buna Qalaa*” which is one of the known local foods “because they suggest that it has no bitter taste or they believe that it has no unpleasant taste naturally. No similar findings reported indigenous knowledge of *Premna schimperi*. How ever its medicinal value, its aromatic leaf, used for wood and fence were reported by Azene Bekele *et al.*, (2007) and Kabra *et al.*, (2015).

4. *Clausena anisata* (*ulumaayii* in afan Oromo)

The plant is one of the plants identified with most multipurpose among the aromatic plants of the study area. It is commonly used as medicine, ritual, stick and teeth brush in the area. The plant is a deciduous shrubs or tree belonging to Rutaceae family or citrus family. *Clausena anisata* height is up to 10m and its leaves, fruits and stem bark are rich in aromatic odor. The fruit of the *Clausena anisata* is edible and has medicinal value for stomach ache. However it is not common to eat its fruit because it can stay for many years without fruit bearing except with great protection for its growth. The plant is nevertheless wild and not properly protected in the study area, thus the plant usually not bearfruit. Similar finding was reported by Mothathoeta.l, (2012) that the plant is wild and different medicinal values.

5. *Ocimum basilicum* (*Kefoo* in local language) and *Ocimum americanum* (*Bassobilaa* in afan Oromo)

Ocimum basilicum is erect annual up to 35cm in height, with ovate, toothed leaves up to 8 cm in length and the plants is known by its diversity, in the genus *Ocimum*, Lamiaceae family collectively called basil. According to (Simon *et al.*, 1999) *Ocimum* comprises more than 30 species of shrubs and herbs from the tropical and subtropical regions and *Ocimum basilicum* can be used as traditional medicine, but there is no information in the case of its medicinal value in the study area.

Ocimum basilicum is one of the commonly known aromatic plants with multipurpose found in the top ten ranked plants in the study area and used for spices, perfume, fumigator and garden ornament. The plant is closely similar with *Ocimum americanum* (*Bassobilaa* in local language) and some the peoples of the study area unknowingly call them interchangeably. This is because of their morphological and their sweet smell similarity. The people were calling them interchangeably, only the peoples of the study wereresponded (specially the spices sellers and users) that they look the same for some peoples, but they are different plants. However the similar finding was reported by Eyasu chemo (2017) on *Ocimum basilicum* concerning its fragrance.

Ocimum americanum is an erect perennial, aromatic plant usually growing 20-30 cm tall. The plant is usually grown as annual in cooler climates. According to Renata *et al*, (2013), among species of *Ocimum*, *Ocimum basilicum* is the major essential oil crop around the world, cultivated in many countries. This agrees with the finding of study area that the peoples prefer *Ocimum basilicum* from *Ocimum americanum* for its aroma, and practically it has sweeter smell.

6. *Ruta chalepensis* (Cilaaddama in afan Oromo)

The plant is originated from the Mediterranean and currently distributed worldwide (Tampe *et al* 2016). *Ruta chalepensis* also known as Fringed Rue in English belongs to Rutaceae family and perennial plant in the study area. The plant is one of the commonly known aromatic spices in the study area among the top ten plants identified by their multipurpose. It is used in traditional medicine and food and drink flavoring, especially for flavoring coffee and milk products such as yoghurt (*Itittuu* in afan Oromo). This is corresponding with reports of (Tampe *et al.*, (2016) and Moa Megarsa, (2010). On other hand no finding in Moa Megarsa, (2010) reported about the plant's aroma. The plant is used for the above mentioned purposes because of its distinctive odor (aroma).

Ruta chalepensis is not wild, rather cultivated for the above mentioned purposes and sometimes as ornamental plants in Wayu Tuka Woreda. This disagree with report of Jemalet *al.*, (2013) that the plant is wild in Tunisia.

7. *Artemisia afra* (Qoddooadiiin local language)

The plant is common to Africa which is aromatic perennial. *Artemisia afra* widely distributed from south part of Africa up to North and east reaching as far north as Ethiopia. It grows unto 1.8 m in height. It is reported that there are other different *Artemisia species* such as *Artemisia Abyssinica*, *Artemisia rehan* and *Artemisia ranunculus* (Mesfin Tadesse and Brook Mesfin, 2010).

The finding of my study agrees with reports of Mesfin Tadesse and Brook Mesfin (2010), Eyasu chemo, (2017) that *Artemisia afra* traditionally used as aerial healing, ritual values and as garden ornament.

4 6.6 Conservation of the identified plants in the study area

As discussed in the above sections the aromatic plants identified in wayu Tuka Woreda used by local peoples for multipurpose. Only few groups of the plants were used for one purpose. However the plants 'conservation is under question when their distribution and uses are compared. The plants that frequently used for multipurpose are very rare in distribution when field observation was carried out. Especially some of the aromatic plants those grow in wild are in threaten condition. For example *Olea capansis* is one of the indigenous plant species in the study area used for different purposes and it is currently very rare in number. The indigenous elders of the study are suggested that it was widely distributed in the study area. However the plant was seen during field observation of selected kebeles, only in wora Babo minya which was one of the study sites. No similar finding was reported concerning *Olea capansis* in the case of its conservation and aromatic bark. However the people of the study area familiar as the plant's bark is aromatic, especially when they are using its burning smog for hive fumigating.

The people focus on those that was cultivating by past generations using traditional means .The modern cultivating means is not widely involved. For example spices such as *Ocimum americanum*, *Ocimum basilicum*, *Tringonella foenum* and *Ruta chalepensis* are much known in the study area that used as income generations for some poor group of peoples .How ever their cultivating way is very poor that only few group of peoples cultivate in their home garden by preparing very limited land. Wild medicinal aromatic plants are also collected from wild only at the time of peoples suffered from the diseases. All the plants that are not cultivated are collected from wild at the time of their specific uses. The users of wild plants in the study area think about the plants when they needed for the purposes by finding in forest. This shows that they are not cultivated and conserved properly. Therefore ,the growing and availability of aromatic plants in the area determined by natural factor, the community's activity or mechanisms of usage and awareness by the people,that they are not using systematically and wisely. This agrees with findings of (Radusiene, (2004), (Mathewos Agize, 2014), and (Guteta Negasu *et al.*, 2016).

Conservation and cultivation of aromatic plants in the study area affected by suitability to cultivate and awareness of the peoples in the case of wisely usage, way of planting, collecting and lack of willingness to change mode of cultivation to more modern. Similar finding was reported by (Eyasu chamo, 2017).

4 6.7 Beliefs on aromatic plants and knowledge of peoples a in the study area

The people of Wayu Tuka District have different knowledge, beliefs and culture concerning their plants. Ritual plants identified in this study are directly related to culture of local community. The people also have their own assumptions about a certain plant by observing just its unique characteristics. For example they believe that a plant as unique advantage if it possesses unique characteristics, such as sweet smell, certain liquor and resinous secretion if they studied in detail.

They can also classify the plants around them depending on their natures and uses. This agrees with report of Moa Megarsa, (2010) that the peoples have deep knowledge how to classify the vegetations around them.

Some group of peoples of the study area has no similar knowledge and perceptions about the plants and their multipurpose. Different respondents did not give the same information on some of same aromatic plants of the study area. For example some of the interviewees were not sure as *Carissa spinarum* root is aromatic. Only the local healers were surely discussing about the use and possession of aroma odor of the plant root.

Those groups of peoples using the plants frequently know properly their aroma. Although the plants are logically aromatic depending on definitions of aromatic plants and suggestions of knowledgeable peoples of the study area, their aroma is not known among few individuals in the study area, thus they don't know as they are group of aromatic plants. This shows that the peoples are familiar with aromatic plants of the study area except few groups those are not using the plants frequently. In other hand their traditional uses are restricted to only groups that are knowledgeable and the women that use spices for seasoning food or b for selling. Related finding was reported by Mathewos Agize, (2014).

On other hand the people's knowledge of aromatic plants that restricted to those frequently using the plant shows that, the usage of the plants among the people of the study area is limited or infant. This is because those deeply know about the plant and frequently use them having no interest to share the idea and experiences. The peoples of the study area classify aromatic plants depending on their uses and aroma parts. This is compatible with the finding reported by Joy *et al.*, (2006).

4.6.8 Habits of aromatic plants in the study area

The identified plants were falling under 31 genera and 24 families. From these families of identified aromatic plants, most of the plants are found under Lamiaceae. This agrees with finding of Eyasu Chamo, (2017). Rutaceae is the second highest frequency occurrence of plant species with 4 plant types from the identified plants, which agrees with finding of Mathewos Agize,(2014) followed by Asteraceae and Zingiberaceae which are equally containing 3 plant species. Therefore the aromatic plants of the study area are generally found under the plant families Lamiaceae, Rutaceae, Asteraceae and Zingiberaceae containing different percentage of occurrence of the total families. There were plant families that contain same number of the plant species under different families.

5. Conclusions and recommendations

5.1 Conclusions

The result of the study shows that there are different aromatic plants found in the study area serving the people in different multipurpose. There are aromatic plants in the study area that have multipurpose in common. The aromatic plants in study area are used among the people in income generation, aromatherapy, spices, ritual, fumigator, food, incense and other common plant purpose such as fire wood, construction and traditional teeth brush. However their uses and cultivation or conservation are not parallelly focused by stake holders. The people of the study area mainly use the leaves of the plants followed by the whole plants. The people of the study area have knowledge about the aromatic plants in their locality. However some aromatic plants are familiar among only the individuals who are local healers. The fragrance of the plants is not recognized by that group who are not local healers. For example *Carissa spinarum* is one of the aromatic roots in the study area but it is not known among many respondents that are not local healers. This shows that the knowledgeable people or local healers have no interest to share their knowledge.

5.2 Recommendations

Aheaded recommendations from results of the study are summarized as follows.

- ❖ Conservation of Aromatic plants of the study area require alert of all stake holders such as the farmers, the plants product sellers, the District's governmental bodies and institutions.
- ❖ The cooperation of all stake holders, especially Agricultural Bureaus, land and environmental protection Bureaus, NOG'S and institutions such as colleges and universities is very important to give awareness to the community of the study area.
- ❖ Familiarity of the plants should not be limited to local healers, elders and knowledgeable peoples, the plants need to be used widely. The sustainability of the plants in the study area can be encouraged by this means.
- ❖ The younger individuals should also practically know the plants and their multiple purposes, this is important to improve the way of using for next generation to ensure the plants sustainability.
- ❖ More awareness should be given for the people by stake holders for sake of improving their utilization mechanism to cope with current world situations. This is possible by educating the peoples about wise utilization of these plants.
- ❖ The threatened species such as *Olea capansis*, *Carissa spinarum* and *Lippia adoensis* needed to be considered. Because some indigenous elders of the study area emphasize that these plant species were found everywhere of some study sites. However currently, these plants are found in very limited study sites.
- ❖ *Aleo vera* (the known aromatic succulent leaf and medicinal plant) found only in Geba Jimata study site should be widely cultivated around home garden, the peoples and agricultural institutions of the Woreda should consider about it.
- ❖ The wild plants that are used for multipurpose should be cultivated around home garden and everywhere able to be available at the time of their specific uses rather than collecting the plants far apart from the natural forest or around the river.
- ❖ The plant species such as *Olea capansis* and related plant species that are threatened in these conditions should get critical focus by all stake holders to ensure their future sustainability.

- ❖ Aromatic plants should be focused for their more profitable in their multipurpose avoiding restriction of the plants cultivation and coservatinon to traditional healers and spices cellers
- ❖ Inidigenous knowledge about the spices' usage and cultivation shouldn't be limited to women and their cellers; it should be shared among all of stake holders.

6. References

- AhaduAyehu and Dawit Abebe (1993). Medicinal plants and enigmatic health practices of northern Ethiopia. Addis Ababa. 83-97
- Anwar Endris, Nigist Asfaw & Daniel Bisrat (2015).Chemical composition, antimicrobial and antioxidant activities of the essential oil of *Lippia javanica* leaves from Ethiopia, *Journal of Essential Oil Research*,[Http://WWW.tandfonline.com/loi/tjeo20](http://WWW.tandfonline.com/loi/tjeo20)
- Azene Bekele(2007). Useful trees and shrubs of Ethiopia: Identification, Propagation and Management for 17 Agroclimatic Zones, Bo Tengen, Ensermu Kelbessa, Sebsibe Demissew and Patrick Maundu (Eds), World Agro forestry Centre, East Africa Region, Nairobi Kenya
- Banjaw (2016). Aromatic and Medicinal Plants in Wondogenet Agricultural Research Center Botanical Garden, South Ethiopia. *Medical Aromatic Plants (Los Angel)* 5:6
- Beiminat Mengesha (2015).Overview of Herbs, Aromatic Plants and Essential Oils Research Ethiopian Institute of Agricultural ,Research Wondo Genet Agricultural Research Center
- Cetinkaya G ,(2009).Conservation and Sustainable Use of Medicinal and Aromatic Plants: A Case Study in KopruluKanyon National Park, Turkey (how to use)
- Chandarana H, Baluja S, Chand S.V (2005). Comparison of Antibacterial Activities of Selected Species of Zingiberaceae family and some synthetic compounds.*Biological journal* (29)
- Chandarana H, Baluja S, Chand SV (2005). Comparison of Antibacterial Activities of Selected Species of Zingiberaceae family and some synthetic compounds. *Biological Journal* 29: 83-97

- Chandra P. K (2015). Medicinal and Aromatic Plants of Tons Watershed in Uttarakhand Himalaya. *Applied Ecology and Environmental Sciences*, 3(1): 16-21.
- Daniel Kalu and Ali Seid (2014) ,Ethnobotanical study of medicinal plants in Ankober Woreda, central Ethiopia, *Ethiopian journal of science and technology*,7(2): 105-114
- Daniel W (1999). *Biostatistics: Foundation for Analysis in health science*. 7th edition .New York :John Wiley and Sons.
- Dawit Abebe (2001). The Role of Medicinal Plants in Health Care Coverage of Ethiopia, the Possible Integration. *Conservation and Sustainable Use of Medicinal Plants in Ethiopia* ,Proceeding of The National Work Shop on Biodiversity and Sustainable USE OF Medicinal Plants In Ethiopia, 28 April-01 May 1998, 6-21. (MedhinZewdu and Abebe Demissew.)
- Demel Teketay (2000). *Ranunculaceae*. In: Edwards, S., Mesfin Tadesse and Sebsebe Demissew and Hedberg, I. (eds.). *Flora of Ethiopia and Eritrea, Vol. 2, part 1. Magnoliaceae to Flacourtiaceae*. The National Herbarium, Addis Ababa University, Addis Ababa, Ethiopia and Uppsala, Sweden.
- Devi D (2014). A Study of Aromatic Plant Species Especially in Thoubal District, Manipur, North East India . *International Journal of Scientific and Research Publications*, 4(6):1-12
- Beemnet Mangesha, Omar sherif, M., Tsion, T., Solomon, A., (2010). Production, processing and utilization of aromatic plants, Ethiopia Institute of Agricultural Research (EIAR), Addis Ababa, Ethiopia
- Edwards, S., Mesfin Tadesse and Sebsebe Demissew (2000). *Flora of Ethiopia and Eritrea*, 2 (1), Magnoliaceae to Flacourtiaceae. The National Herbarium, Addis Ababa University, Addis Ababa and Uppsala

- EndalewAmenu (2007). Use and Management of Medicinal Plants by Indigenous People of Ejaji area (ChelyaWoreda), West Shoa, Ethiopia: an Ethnobotanical Approach. M.Sc. Thesis. Addis Ababa University
- Rubatzskey, V.E., Quiros, C.F., Simon, P.W., (1999) Carrot and related vegetable, USA 39-40.
- Eyasu Chama (2017).Traditional Uses and Medicinal Value of Aromatic Plant Species in Home Gardens of Sodo-Zuria District in Wolayta Zone.International Journal of Science and Research (IJSR, 6(6):2741-2746
- FAO (2005).Herbs, spices and essential oils. Post harvest operation in developing countries, Vienna and Rome
- FAO (1995). Ethiopian plant genetic Resources center, Country report international technical conference on plant genetic resources, 1996 Leipzig, German
- FAO (2011).Spices and herbs for home and market, Melanie Matthews and Michael Jack. Rural Infrastructure and Agro-Industries Division Food and Agriculture Organization of the United Nations, Rome, Italy
- FAO (2012). Health and wealth from Medicinal aromatic plants, booklet 17, Rom, Italy
- Geetha K. A (2007). Horticulture, Floriculture.(Ornamental, Medicinal & Aromatic Crops) Medicinal and Aromatic Plants in India National Research Center for Medicinal and Aromatic Plants Boriavi, Anand
- Gemedo Dalle (2004). Plant biodiversity and Ethnobotany Borena pastoralists in southern Oromia, Ethiopia
- Gilbert (1995).Euphorbiaceae.Edwards, S., Mesfin Tadesse and Hedberg, I. (Eds.). Flora of Ethiopia and Eritrea Vol. 2:2. Centallaceae to Euphorbiaceae.The National Herbarium, Addis Ababa and Uppsala, 265-380pp.

- Girm aHailemichael, DigafieTilahun, EdossaEtisa, Belay YemanBirhan and WeyessaGaredew (2008) .Spices research achievements, revised edition, Ethiopian Institute of Agricultural Research, Addis Ababa Ethiopia.
- Goettsch, E. (1991).*Traditional aromatic and perfume plants in central Ethiopia (a botanical andethno-historical survey)*, pp. 114-122.
- Green P.S. (1952).Oleaceae.*Inga Hedberg, Sue Edwards & Sileshi Nemomissa (Eds)*. Flora Of Ethiopia and Eritrea, Apiaceae ToDipsacaceAddis Ababa, Ethiopia Uppsala And Sweden 49(1):79-83
- Guteta Negasu, Nigussie Banchiamlak, Mokonen Mihirat (2016).Composition, distribution and economic importance of insect pests ofprioritized aromatic plants in some growing of Ethiopia International journal of Advanced Biological and Biomedical Research 4(1)pp 1–9
- Hey wood V. (1999).Medicinal and aromatic plants as Global resources , Biological resource, sustainable use, conservation, ethnobotany,edsN.caffiene et al,pp 21-28
- Hillson, R.M(1988). Gold, frankincense and myrrh. Journal of the royal society of medicine 81(9):542–54,
- IBC (Institute of biodiversity conservation) (2007). Ethiopia: Country report on the state of plant genetic resources for food and agriculture to FAO, Addis Ababa
- James F. (1997). Herbal healers, The catholic Health Association of India, pp3-9
- JemalM ,Bouajil J A, Safouane Ben , Sik Ali and ManefAbderrabba (2013).Rutachalepensis L Essential oil:chemical composition and phytotoxic activitiy Journal of Biologically active products from nature PP 39-50,Tunisia

- Joy P. P., Thomas J., Samuel Mathew, Gim Jose and Johnson Joseph (2002). Aromatic and Medicinal Plants Research Station
- Joy P.P.Baby,Skariap,MathewS.MathewG,Joseph A and Joseph R.(2006). Aromatic plants, Horticultural sciences Prof. K.V. Peter (eds) Volume 7,Kerala, India (7):7-21
- Joy, P.P., Skaria, B.P., Mathew, S. and Mathew, G(2005).Cinnamon for flavour and aroma. Ind. J. Arecanut, Spices and Med. Plants, 7:1-6Bhuwan K. Chhetri , Nasser A. Awadh Ali and William N. Setzer (2015). A Survey of Chemical Compositions and Biological Activities ofYemeni Aromatic Medicinal Plants .Medicines2, 67-92
- Joy, P.P., Thomas, J., Mathew, S., Jose, G. and Joseph,J(2001).Aromatic plants.Tropical Horticulture (eds. Bose, T.K.,Kabir, J., Das, P. and Joy, P.P.). NayaProkash, Calcutta, (2) 633-733
- Kabra .A ,Kabir .R a and Baghe U. S(2015).Premna Species Review. Biology of Chemical Chronology 1(1):55-59
- Martin, G.J (1995). Ethnobotany: A method Manual. Chapman and Hall, London. 265-270
- Mathewos Agize (2014) .Ethnobotany of spice and condiment plants and the association of indigenous knowledge on management, utilization and conservation of them around Home gardens in Loma and Gena Bosa Districts of Dawuro zone, southwest Ethiopia. Agricultural innovation research .3(2): 426-441
- Mesfin Tadesse and Brook Mesfin (2010) .A review of selected plants used in the maintenance of health and wellness inEthiopia, Ethiopian e Journal for research and innovation Health 2(1): (85 -102).
- Moa Megersa (2010).Ethnobotanical Study of Medicinal Plants in WayuTukaWoreda ,East Wollega Zone of Oromia Region,Ethiopia,A thesis ,Addis Ababa university

- Mothatheo A. Mogale¹, Henry M. Mkhombo¹, Sogolo L. Lebelo², Leshweni J. Shai, Mildred AChauke and Anette de Freitas(2012). The effects of *Clausenaanisata*.Hook leaf extracts on selected diabetic related metabolizing enzymes.Journal of Medicinal Plants Research 6(25): 4200-420
- Mulugeta Lemenih and Demel Teketay (2003). Frankincense And Myrrh Resources Of Ethiopia: Medicinal And Industrial USES. Ethiopian Agricultural Research Organization, 26(2):161-172, Addis Ababa, Ethiopia
- Okigbo R. N.,Anuagasi C. L. and Amadi J. E (2009).Advances in selected medicinal and aromatic plantsindigenous to Africa. Journal of Medicinal Plants Research 3(2): 86-95 .
- Patel D.K (2014).Aromatic Plants Vegetative Propagation and *ex-situ* Conservation in Herbal. Garden Asian Journal of Conservation Biology, 3 (2):152–155
- Patel (2015).Aromatic plants diversity showing their propagation byseeds for *ex-situ* conservation in herbal garden Journal of Pharmacognosy and Phytochemistry 3(5): 152-156
- Patra N. K. and Kumar B(2006).Spearment, V. Peter (eds). Handbook of herbs and spices, Boca Rota, Florida USA .3:502-516
- Radusiene .J (2004).Trade, Use and Conservation of Medicinal and Aromatic Plants in Lithuania.Future for Medicinal and Aromatic Plants. (Eds. Craker L.E.)
- Renata N.W (2013).Morphological and chemical variabilityof *Ocimum basilicum*L. (Lamiaceae). Journal of Modern Phytomorphology 3: 115–118
- RetaRegassa (2013) .Diversity and conservation status of some economically valued indigenous medicinal plants in HawassaCollege of Teacher Education Campus, Southern Ethiopia ,International Journal of Advanced Research (1) 308-328

- Sebsebe Demissew and Inger Nordal (2010). *Aloes and Lilies of Ethiopia and Eritrea* Addis Ababa University and University of Oslo
- Sharma (2006). Irradiation to decontaminate herbs and spices, V. Peter (eds). Handbook of herbs and spices, Boca Rota, Florida USA (3):60-72
- Sharma, A., Tewari, R. and Virmani, O.P (1987). French Basil (*Ocimum basilicum* L.) A review. Current Research Medicinal Aromatic Plants, 9:136-151,
- Shiferaw Teshome, Teshome Soromessa, Tileye Feyissa, aiwania (2016). (2016) ,Development of an efficient in vitro propagation protocol for *Satureja punctata*- A rare aromatic and medicinal plant 61(1): 41–48
- Simon, J.E, M.R. Morales, W.B. Phippen, R.F. Viera, and Hoa. (1999). Basil: A source of aroma compounds and popular culinary and ornamental herb. p 499-505. In: J. Janick (ed.), perspectives on new crops and new uses, Alexandria.
- Skaria B. P Joy., P. P., Mathew S. and Mathew G (2006). Lemongrass, Aromatic and Medicinal Plants Research Centre, India , V. Peter (eds). Handbook of herbs and spices, Boca Rota, Florida USA .3:400-415
- Tamirat Girma, Muluken Philipos and Shewaye Abera (2014). Profitability Study of *Hibiscus sabdariffa* .Production around Wando Genet District, Ethiopia). Science, Technology and Artist Journal 3(4): 214-218 Shashamane, Ethiopia
- Tampe J, Parra L., Huaiquil K. and Quiroz A (2016). Potential repellent activity of the essential oil of *Rutachalepensis* (Linnaeus) from Chile against *Aegorhinus superciliosus* (Guerin) (Coleoptera: Curculionidae). Journal of Soil Science and Plant Nutrition, 16 (1): 48-59

Thomas, J., Joy, P.P., Mathew, S., Skaria, B.P., Duethi, P.P. and Joseph, T.S (2000). *Agronomic Practices for Aromatic and Medicinal plants*. Directorate of Arecanut and Spices Development, Calicut, 124p;

World health organization (WHO)(2002). Traditional Medicine Strategy 2002- 2005". Geneva.
From http://whqlibdoc.who.int/hq/2002/WHO_EDM_TRM_2002.1.pdf

Yadav H. R (2013). Medicinal plants in folk medicine system of Ethiopia
Journal of Poisonous and Medicinal Plants Research Vol. 1(1), pp. 007-011

Zelege Tenssay (2016). Identification of *Lippia adoensis* for access and benefit sharing in Ethiopia (Review)

Appendix 1: Check lists of questions translated in to Afan Oromo
Jimma University

College of Natural science

Department of Biology

Questionnaire on the traditional utilization of aromatic plants for different purposes among the peoples of Wayu Tuka Woreda

Please fill the space provided with the appropriate information or sign the letter of your favorite

I. personal information

1. Age

Umuri

2. Sex, A. Male B. Female

Saala, A. Dhiira. B. dubara

3. Address A. Rural B. Urban

Teessoo A. Magaalaa B. Baadiyyaa

4. Religion A. Protestant B. Orthodox C. Musilims

Amantaa A. pirootestaantii B. Ortodoksii C. Isilaama.

5. Ethnicity A. Oromo B. Amhara C. Gurage others (specify)

Lammummaa A. Oromoo B. Amaara. C. Guraagee .kan birraa yoo taate ibsi.

6. Occupation A. Government employee B. House wife C. Merchant

D. Farmer E. Student F. Others

Gosahojii .A. Hojjetaa mootummaa B. Haadhamanaa C. Daldalaa

7. Educational level A. Illiterate B. Literate (B₁. Grade 1-4

B₂. Grade 5-8 B₃. Grade 9-10 B₄. Grade 11-12 B₅. College or university

Haala barnootaa. A. kan hin baratiin B. Kan barate (B₁. Kutaa 1-4

B₂. Kutaa 5-8 B₃. Kutaa 9-10 B₄. kutaa 11-12 B₅. kolleejjii ykn yuunversiitii

II. About the aromatic plants and usage in the area

1. Do you have knowledge about Aromatic plants?

A Yes B No

Biqiloota Foolii urgaa'u qaban beektaa/tuu?

A. Eyyee B. Lakki

How can you explain these plants?

Haala kamiin biqiloota kana ibsuu dandeessa?

2. How many aromatic plants can you list in your locality?

Biqiloota naannoo keessanii fooliin isaanii urgaa'u meeqa maqaa dhahuu ykn tarreessuu dandeessu?

Write local name of each aromatic plants

Tokkoo tokkoo Biqiloota beektu kanaa maqaa naannoo tiin tarreessi/waami.

2. How many of aromatic plants that are cultivated by the people and naturally grown can you list in your locality?

A. Cultivated aromatic plants:-

B. Naturally grown aromatic plants:-

Biqiloota fooliin isaanii urgaa'an kana Kannamaan dhaabamanii kunuunf amanii fi namaan dhaabamanii hin kunuunfamne meeqa beekta?

A. Biqiloota fooliin isaanii urgaa'an kannamaan dhaabamanii kunuunfaman:-

B. Biqiloota fooliin isaanii urgaa'an kannamaan dhaabamanii hin kunuunfamne:-

2. For what purposes peoples use aromatic plants in your community?

A .Food B. spices C. Medicines D. cosmetics .E .perfumery

. F. Hundumaaf

If any other purposes of aromatic plants in your society specify

A. For food_____ D cosmetics_____

B. For spices_____ E Perfumery_____

C. Medicinal _____

Hawaasa naannoo keessanii keessatti Biqiloota fooliin isaanii urgaa'n namootni maalfa'iif fayyadamu?

A .Nyaataaf B. Urgeessituu ykn mi'eessituuf C. Qorichummaaf D.

Dibatamiidhaginaaf .E .Urgaadhaaf

Faayidaalee kan biro yoo jiraatan ibsi.

- A. Nyaataaf _____
- B. Mi'eessituuf ykn qimamiif_____
- C. Qorichummaaf kan oolu _____
- D. Dibata miidhaginaaf_____
- E. Urgaadhaaf_____

5. What part of the plant parts used? Write the name of the plant in front of each letter.

- A. Leaf_____
- B. Stem_____
- C. Root _____
- D. Bark_____
- E. Flower_____
- F. Seed_____

Qaamoleen Biqiloota kanaa faayidaalee kanaaf oolan maal isaniiti? Fuula duratti maqaa isaanii barreessi.

- A. kan baalli isaa fayyadu_____
- B. kan jirmi isaa fayyadu _____
- C. kan hundeen isaa fayyadu _____
- D. kan qolli isaa fayyadu _____
- E. kan daraaraan isaa fayyadu _____
- F. kan firiin isaa fayyadu _____

6. List spices aromatic plants in the area as much as you can.

- 6.1. Aromatic plants that their leaves used for spices_____
- 6.2. That their tuber used for spices_____
- 6.3. That their root used _____
- 6.4. That heir bark used_____
- 6. 5. That heir Flower used_____

7. Do your local people get income from any aromatic plant? A. Yes B. No.

A. Yes B. No.

Namootni naannoo keessanii Biqiloota fooliin isaanii urgaa'u irraa madda galii ni argatuu?

A.Eeyyee B.Lakki

For what purposes they sell the plant?

A. spices B. Medicines C. Perfumery D. cosmetics E. Food

Specify if any other purposes, _____

Faayidaaleemaalfa'iifbituykngurguru?

A.Urgeessituu ykn mi'eessituuf C.Dibata adda addaatiif

B.Qorichummaaf D.Nyaataaf

Faayidaa biro yoobeektebsi, _____

Appendix 2: Lists of Key informants participated in different in comparisons of selected plants used in ranking techniques

	Name	Age	Kebele	Job	Educational	Religious
1	AshimAmenu	60	Gaba Jimata	Farmer	Illiterate	Muslim
2	KidanuGobena	37	Gaba Jimata	Farmer	2ndry school	Protestant
3	Abebecemadaa	50	Geba Jimata	Employed	Elementary	Protestant
4	DirribaWendimu	30	Gaba Jimata	Farmer	Elementary	Protestant
5	Higuolana	45	W/B/Minya	Farmer	Illiterate	Protestant
6	Kitilaa	60	W/B/Minya	Farmer	Illiterate	Protestant
7	GemachuTamena	39	W/B/Minya	Farmer	Elementary	Protestant
8	Kinde	30	W/B/Minya	Employed	College	Protestant
9	ItanaHambisa	33	Gute Magala	Farmer	College	Protestant
10	ImiruTamesgen	30	Gute Magala	Employed	College	Protestant
11	CalaHordofa	40	Gute Magala	Employed	College	Protestant

12	MasfinBekele	35	Gute Magala	Employed	College	Protestant
13	Firdisa Aga	47	Dalo Komto	Farmer	Elementary	Orthodox
14	YadasaTolasa	53	Dalo Komto	Employed	College	Orthodox
15	FirdisaBekela	57	Dalo Komto	Employed	College	Orthodox
16	Adam Fikadu	39	Dalo Komto	Employed	College	Orthodox
17	BeyanaAbdisa	48	Bonaya Molo	Farmer	Elementary	Protestant
18	IddosaEba	40	Bonaya Molo	Farmer	Elementary	Protestant
19	JambareCamada	45	Bonaya Molo	Farmer	Elementary r	Protestant
20	DammanuGari	29	Bonaya Molo	Bonaya M.	Illiterate	Protestant

Appedix 1: Lists of Aromatic plants of the study area

SH=Shrub, T=Tree, H=Herb C=cultivated, W= Wild, B=Both

Count	Local /Afan oromo name/	Habitat	Family	Scientific name	Callin g number	Cultiv ation status
1	Agamsa	Sh	Apocynaceae	<i>Carissa spinarum</i> L	1	C
2	Aloe(English)	H	Asphodelaceae	<i>Aloe vera</i>	2	C
3	Ancabbii	Sh	Lamiaceae	<i>Ocimum urticifolium</i> Roth	3	W
4	Arangamaa gurraacha	Sh	Capparaceae	<i>Caparis sepiaria</i> L	4	W
5	Baargamoo adii	T	Myrtaceae	<i>Eucalyptus globulus</i> Labill	5	C
6	Barashee/aswiichii/	H	Asteraceae	<i>Tagetes minuta</i> L	6	W

7	Buna	T	Rubiaceae	<i>Coffea arabica L</i>	7	C
8	Burtukaana	T	Rutaceae	<i>Citrus sinensis (L.) Osborne</i>	8	C
9	Caatii	T	Celastraceae	<i>Catha edulis(Vahl) Forssk ex Endl</i>	9	C
10	Cilaaddama	H	Rutaceae	<i>Ruta chalepensis L.</i>	10	C
11	Dabaqqaa	T	Combretaceae	<i>Terminalia schimperiana</i>	11	W
12	Dimbilaala	H	Apiaceae	<i>Coriandrum sativum L</i>	12	C
13	Ejersa	T	Oleaceae	<i>Olea europeaL. subsp. cuspidata(Wall. Ex G. Don) cif.</i>	13	C
14	Foolii aayyoo/qoricha Goondaa	H	Chenopodiaceae	<i>Chenopodium ambrosioides L.</i>	14	W
15	Gaattiraa	T	Cupressaceae	<i>Juniperus procera Hochst. ex Endl</i>	15	C
16	Gajjaa	T	Oleaceae	<i>Olea capensis</i>	16	W
17	Inshilaala(fennel)	H	Apiaceae	<i>Foeniculum vulgare Miller</i>	17	C
18	Irdii	H	Zingiberaceae	<i>Curcuma longa</i>	18	C
19	Ittacha	Sh	. Sapindaceae	<i>Dodonaea angustifolia L.</i>	19	W
20	Jibinbila	H	Zingiberaceae	<i>Zingiber officinale Roscoe</i>	20	C
21	kasee	Sh	Verbenaceae	<i>Lantana trifolia</i>	21	W
22	Kefoo	H	Lamiaceae	<i>Ocimum basilicum L</i>	22	C
23	Kefoo sa'aa	H	Lamiaceae	<i>Satureja</i>	23	W

				<i>paradoxa</i> (Vatke) Engl. ex Seybold		
24	kossobilaa/bassobila a	H	Lamiaceae	<i>Ocimum americanum</i> L.	24	C
25	Kusaayee	H	Verbenaceae	<i>Lippia adoensis</i> Hochst. ex walp	25	W
26	Loomii	T	Rutaceae	<i>Citrus limon</i> (L.)	26	C
27	Maangoo	T	Anacardacea e	<i>Mangifera indica</i>	27	C
28	Marga citaa	H	Poaceae	<i>Cymbopogon citratus</i> (DC.) Stapf	28	C
29	Naanayee	H	Lamiaceae	<i>Mentha spicata</i>	29	B
30	Oogiyoo/korrorimaa	H	Zingibraceae	<i>Aframomum corrorima</i> (Braun) Jansen	30	C
31	Qoddoo adii/Arrittii	H	Asteraceae	<i>Artemisia afra</i>	31	C
32	Qullubbii diimaa	H	Alliaceae	<i>Allium cepa</i>	32	C
33	Qullubbii adii	H	Alliaceae	<i>Alium sativum</i> L.	33	C
34	Qunnii	H	Cyperaceae	<i>Cyperus rotundus</i>	34	W
35	somboo	T	Meliaceae	<i>Ekebergia capensis</i> Sparrm.	35	W
36	sunqoo	H	Fabaceae	<i>Tringonella foenum</i>	36	C
37	Tamboo	H	Solanaceae	<i>Nicotiana tabacum</i>	37	C
38	Timaatima	H	Solanaceae	<i>Lycopersicon</i> <i>esculentum</i> (L.) Mill	38	C
39	Ulumaayii	Sh	Rutaceae	<i>Clausena aniseta</i>	39	W
40	Urgeessaa	T	Lamiaceae	<i>Premna schimperi</i>	40	W

Appedix 2: photo samples of aromatic plants in in study sites during field observation



Fig 4.1 *Chenopodium ambrosioides* L. around Gute Magala



A

B

Fig 4.2 *Mentha spicata* (A) and *Ocimum urticifolium* Roth (B)



Fig 4.3 *Olea capensis*



Fig 4.4 *Tagetes minuta*



Fig 4.5 *Ocimum atrium* in Dalo komto



A

B

C

Fig 4.6 komtoMountain (A), *Juniperus procera* (B) and *Eucalyptus globulus* (C)



Fig 4.7 *Citrus limon* (cultivated)



Fig 4.8 *Cyperus rotundus*



A



B

Fig 4.9 *Olea europea* (A) and *Dodonaea angustifolia* L(B)



Fig 4.10 *Lippia Adoensis* found almost in all study sites



Fig 4.11 A *Foeniculum vulgare* Mille



Fig 4.12 B & C *Aframomum corrorima* and *Allium sativum* L



Fig 4.13 *Coriandrum sativum*L



Fig 4.14 *Aloe Vera* photo taken from Geba Jimata



Fig 4.15 roasted *coffea arabica* Perfuminghome (A) and *Nicotiana tabacum* t(B)



Fig 4.16 *Ekebergia capensis* Sparrm



Fig 4.17 Interview, discussion, and field observation with indigenous and knowledgeable peoples



Fig 4.18 .Root and tree of *carrisa spinarum*



A

B

Figure 4.19 the leaves of *Olea europaea* (A) and when hive is Fumigating by *Olea capansis* (B)



A

B

Fig 4.20 *Ocimum americanum* (A) and *Ocimum basilicum* (B)

Appendix 3: All the families under which the identified plants found in the study area

Count	Families	Frequency	Percent	Valid Percent	Cumulative Percent
1.	Apocynaceae	1	2.5	2.5	2.5
2.	Asphodelaceae	1	2.5	2.5	5.0
3.	Lamiaceae	6	15.0	15.0	20.0
4.	Capparaceae	1	2.5	2.5	22.5
5.	Myrtaceae	1	2.5	2.5	25.0
6.	Alliaceae	2	5.0	5.0	30.0
7.	Rubiaceae	1	2.5	2.5	32.5
8.	Solanaceae	2	5.0	5.0	37.5
9.	Celastraceae	1	2.5	2.5	40.0
10.	Rutaceae	4	10.0	10.0	50.0
11.	Combretaceae	1	2.5	2.5	52.5
12.	Apiaceae	1	2.5	2.5	55.0
13.	Oleaceae	2	5.0	5.0	60.0

14.	Chenopodiaceae	1	2.5	2.5	62.5
15.	Cupressaceae	1	2.5	2.5	65.0
16.	Poaceae	1	2.5	2.5	67.5
17.	Asteraceae	3	7.5	7.5	75.0
18.	Cyperaceae	1	2.5	2.5	77.5
19.	Sapindaceae	1	2.5	2.5	80.0
20.	Zingibraceae	3	7.5	7.5	87.5
21.	Anacardaceae	1	2.5	2.5	90.0
22.	Meliaceae	1	2.5	2.5	92.5
23.	Verbenaceae	2	5.0	5.0	97.5
24.	Fabaceae	1	2.5	2.5	100.0
Total		40	100.0	100.0	

Appedix 4: The uses of parts of identified plants in the study area with certain aroma

Uses	Plant name	Part used	Process of using
Cosmetic	<i>Cyperus rotundus</i>	Root	The dried root grinded and applied on women' hair and face with fresh butter
	<i>Artemisia afra</i>	Leaf	the dried leaf grinded and applied on women' hair with fresh butter
Spice	<i>Zingiber officinale</i> <i>Curcuma longa</i>	Rhizome	The rhizomes peeled , cleaned, cut in piece or dried and grinded to b applied to appropriate foods
	<i>Allium cepal</i> <i>Alium sativum</i> L.	Bulb, fresh leaf	Bulbs peeled ,cut in piece or the dried grinded bulbs are well prepared to make appropriate foods
	<i>Ocimum americanum</i> L	Leaf, seed or flower	The leaves just added into milk or yoghurt, fresh flower and seed grinded and added into fresh pepper to make additional spices
	<i>Coriandrum sativum</i> L	Leaf ,seed	Fresh leaf used to make other spices prepared from fresh pepper locally kwon as Qocqocaa or doqqoo in

			Afan oromo The seed well processed and added in to suop
	<i>Lycopersicon esculentum</i> (L.)	Fruit	The fresh fruit well processed and added into soup
	<i>Foeniculum vulgare</i> , <i>Aframomum corrorima</i> <i>are</i> <i>Tringo nellafoenum</i>	Seed	The dried seeds grinded and added in to soup and other foods such as bread or injera before it is prepared
Perfume or scent	<i>Cymbopogon citratus</i>	Leaf	The leaf cut and perfumed in home and also smelled
	<i>Artemisia afra</i>	Leaf	The leaf cut and smelled
	<i>Ocimum basilicum</i> L <i>Lippia adoensis</i>	Leaf	The leaf cut and just perfumed in home and smelled
	<i>Citrus limon</i> , <i>Citrus sinensis</i>	Fruit, leaf	The fruit and leaves just smelled
Food	<i>Allium cepal</i>	Whole plant	The bulb other parts such as fresh leaf and succulent stem cut and cooked with other spices and just eaten
	<i>Mangifera indica</i> , <i>Citrus sinensis</i> (L.) Osb	Fruit Fruit	The fruits peeled and just eaten
	<i>Lycopersicon esculentum</i>	Fruit	The fresh ripened enough fruit just eaten or cut into pieces eaten by adding salt other food supplement such as well prepared pepper
Garden ornament	<i>Cymbopogon citratus</i> Stapf <i>Artemisia afra</i> <i>Ocimum basilicum</i>	Whole plant	The plants plant in or around compound
Fumigator	<i>Ekebergia capensis</i> <i>olea capensis</i>	Bark	The dried bark burned and fumigated into hive

	<i>Satureja paradoxa</i> <i>Ocimum basilicum L</i> <i>Lippia adoensis</i> <i>Ocimum americanum L</i>	Leaf	The fresh leaves just applied into food containers such as milk or yoghurt and hives, sometimes applied on surfaces objects and in homes
	<i>Combretum molle</i> <i>Olea europeaL</i>	Wood	The dried wood burned and fumigated into hive and food containers such as milk and yoghurt
Insect Repellent	<i>Chenopodium ambrosioides(L)</i> <i>Tagetes minuta</i>	Leaf.	The fresh leaf just applied on ants invading places
Incense	<i>olea capensis</i>	Bark	The dried bark burned and perfumed in home
	<i>Lippia adoensis</i> Hochst. ex walp	Leaf	The dried leaf burned and perfumed in home
Ritual	<i>Clausena anisata,</i> <i>Premna scimperi,</i> <i>Juniperus procera</i>	Whole plant	The whole plants used on holy days and ceremonies, sometimes as decorations
	<i>Satureja paradoxa</i>	Leaf flower	The leaves and flowers used as decorations and perfuming on holy day of new year
Stimulant	<i>Catha edulis</i> (Vahl) Forssk ex Endl	Leaf	The fresh leaves just chewed
	<i>Nicotiana tabacum L</i>	Leaf,	The dried leaf burned and smoked
	<i>Coffea arabica L.</i>	Seed	The dried roasted seed just smelled, grinded and prepared for coffee drink(very common)
Herbal tea	<i>Ruta chalepensi Sl</i>	Leaf, seed and flower	The fresh leaf, seed or flower applied into tea or coffee for flavoring or for medicinal value.
	<i>Mentha spicata L,</i>	Leaf	The fresh leaf applied in to tea