IMPORTANT MEDICINAL PLANTS OF ETHIOPIA: USES, KNOWLEDGE TRANSFER AND CONSERVATION PRACTICES

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Contents

Summary

Ethiopia is endowed with a rich diversity of flora owing to its heterogeneous agroclimatic conditions. Following this, over 6,500 species of vascular plants, of which about 887 species of medicinal plants were identified and recorded in the country. These are distributed in different agroclimatic zones of the country ranging from dry-hot low land areas in the Rift Valley zones (< 500 m) to Wet Alpine-frost zones of Ras Dejene and Bale Mountains (> 3700 m). Among these recorded medicinal plants in Ethiopia, 60 species were identified as important medicinal plants. Of these,

- *Ocimum lamiifolium* Hochst. ex Benth,
- *Vernonia amygdalina* Delile,
- *Allium sativum* L.,
- *Ruta chalepensis* L.,
- *Lepdium sativum* L,
- *Hagenia abyssinica* (Bruccie) T.F.Gmel,
- *Calpurnia aurea* (Ait.),
- *Carica papaya* L.,
- *Olea europaea* L. subsp. cuspidata (Wall. ex G. Don) and

- *Croton macrostachyus* Hochst. ex Delile

are the *top ten* medicinal plants widely used in traditional treatments.

Most of the public health problems of the country's population, and widely treated ailments include *malaria, diarrhea, fever illness, evil eye, wound, abdominal pain, skin diseases* and *stomachaches*. These diseases can be traditionally treated using different parts of the medicinal plants. The traditional healer have mostly used roots and leaves of medicinal plants to prepare remedies for treating diseases; but this in turn, leads to deforestation. In addition, agricultural expansions, lack of awareness, modernization, habitat destruction, firewood gathering, overgrazing by cattle, and construction projects are the most devastating threats to medicinal plants. Furthermore, most of the practitioners unfortunately lack awareness and experience in matters of conservation and utilization of resources (medicinal plants) in a sustainable manner so far. Thus, despite some efforts in conserving natural resources in Ethiopia, applying *in-situ* and *ex-situ* conservation measures would be a critical need for sustainable development. The aim of this chapter is mainly to identify and document important medicinal plants and the reasons behind their value, means of indigenous knowledge transfer, and conservation practices used for managing medicinal plants in the country.

1. Introduction

Plants are indisputably very valuable sources of medicines, foods, spices, clothing, shelters, flavors, fertilizers, and above all elements in the regulating mechanisms of climate change. Medicinal plants are dominantly used in the healthcare system of the majority of world's population, mainly in developing countries, where herbal medicine has a long history of use for relieving pain and to cure various diseases. According to the World Health Organization (WHO), 80% of the world population depends on traditional medicine to satisfy their daily needs by the use of the natural products of animals and plants. Globally, about 17-18% (77000-78000 species) (*These numbers of medicinal plant species are large in number (Rao and Rajput, 2010; Woldeab et al., 2018) and may vary when you refer to other documents; however, there are many plants not yet identified, globally)* of world flora is used for medicinal purposes. From these plants species, about 3000 species have been traded in the world markets, of which only 900 species are under cultivation. However, only about 100 plant species have been used as sources of modern drugs. Closely 50% of the modern drugs are derived from natural products. Humans acquired the knowledge on the utilization and management of plants for treatment values through many years of cautious observations, experience, and trial and error experiments. Hence, these medicinal plants have become the foundations of typical traditional systems of medicine for thousands of years, and remain in providing humans with new medicines. This implies that the relationship between humans and plants is as ancient as human existence on earth.

By the end of 19th century, scholars began to study the close interactions of humans with plants, under the field of ethnobotany that was first coined by John Hershberger in 1895. Ethnobotany was further elaborated and redefined by Martin (1995) and Cotton (1996) as the study of plants and associated indigenous knowledge of the local people on how to utilize and manage them. Therefore, ethnobotanical study is very essential for

biodiversity conservation and indigenous knowledge documentation, which would be influenced by human activities.

A number of African medicinal plants have been used traditionally for thousands of years, and have been the sources of modern drugs. In African traditional medicine, the traditional healers provide health care services based on knowledge, attitudes, culture, religious background, and beliefs that are widespread in the community, including in Ethiopia. This indicates that medicinal plants are widely used in developing countries, mainly because these are readily available and cheaper than modern medicines. Although a larger number of the medicinal plants have been studied and documented so far, this chapter focuses on important medicinal plants largely used for treating human ailments.

In Ethiopia, medicinal plants provide a vigorous contribution to human and livestock health care systems. Actually, medicinal plants of Ethiopia have shown very effective medicinal value for many human ailments, and some of domestic animals, particularly where modern public health services are limited or not accessible.

Most of medicinal plants are obtained from wild forests or wild habitats. There are also minor cultivation practices of medicinal plants in home gardens. However, the wild forests are exposed to human interferences that lead to deforestation. As a result, many of medicinal plants are threatened; thereby the associated indigenous knowledge is also affected in similar manner. Moreover, despite the great role of medicinal plants and their products in the primary health care, little effort has so far been made in the country to appropriately document and promote the associated indigenous knowledge. Generally, in Ethiopian traditional medicine, medicinal plants and the indigenous knowledge are useful; yet, both of them are threatened due to different anthropogenic factors, which need appropriate conservation measures, and sustainable utilization.

Natural compounds isolated from various parts of the plant parts such as leaves, fruits, stem, roots, and seeds have been shown to possess excellent medicinal values. Thousands of plant varieties used in folklore medicine have been studied for treatment of various diseases such as cancer, diabetes, arthritis, and infectious diseases. However, it currently remains as an area of research interest for presenting the medicinal values of several plant species that are not studied thoroughly. Therefore, this chapter focuses mainly on identifying and documenting the important medicinal plants and their importance, means of indigenous knowledge transfer, and conservation practices used for managing medicinal plants in the country.

2. Methods of Screening Criteria of Important Medicinal Plants

The main sources of data for writing this chapter were secondary data sources including journals, theses, books, government and non-governmental reports, and proceedings. These documents were searched from Google Scholars, Science Direct and Web of Sciences as well as from digital libraries of Debre Berhan University, Ethiopia. They were collected between October, 2020 and January, 2021 using the specific searching terms such as medicinal plants and their uses in Ethiopia, traditional uses of medicinal plants, indigenous knowledge, management of medicinal plants, and names of the

regional states of the country, as well as the specific names of some medicinal plants such as *Ocimum lamiifolium* and *Ruta chalepenses*.

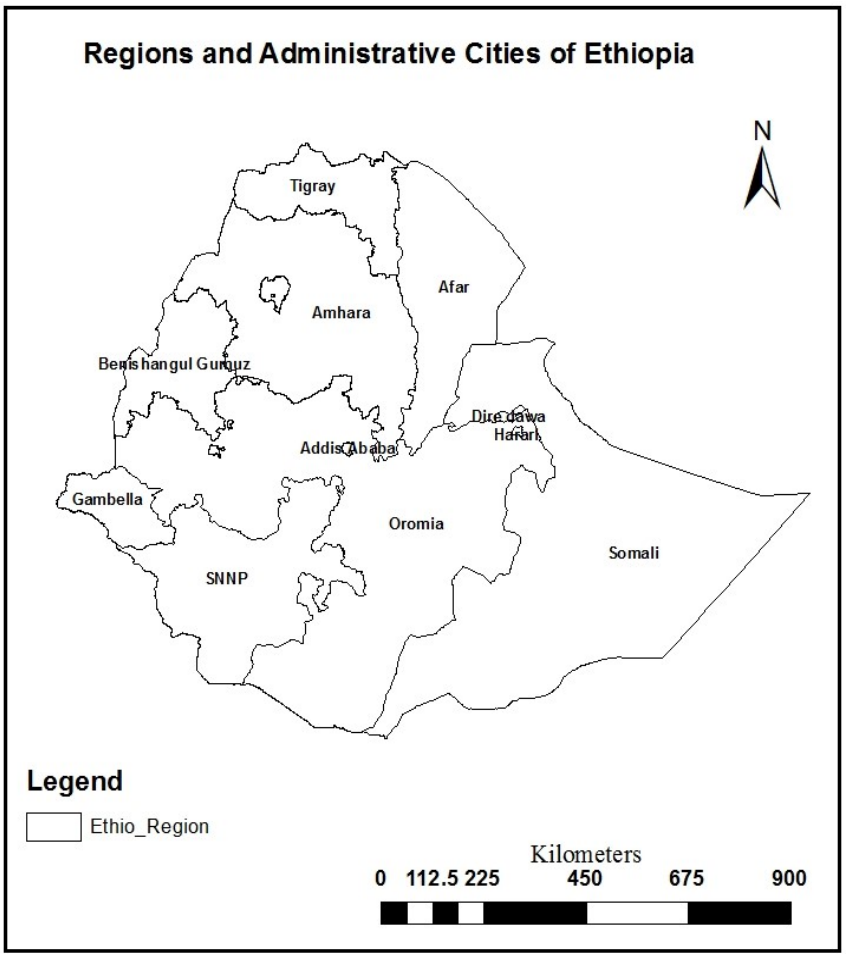

Figure 1. The current map of regional states of Ethiopia, where important medicinal plants are found. This map is adopted from https://www.mappr.co/political-maps/ethiopia/

Additionally, for the screening of important medicinal plants (Appendix 2), the fidelity level (*Fidelity level is a statistical tool to measure the potentiality of the specific plant for treating the specific disease (Friedman et al. 1986), whereby it enables the scholar to identify the most important species*), the citation frequency of medicinal plants (at least in three reviewed articles) and the availability of important and adequate information of each of the medicinal plants in the reviewed documents were taken into consideration. In addition, the availability of the medicinal plants in the country was also noted from the Flora books of Ethiopia and Eritrea. Accordingly, a total of 51 reviewed papers and documents, of which 27 articles, written at either of the regions of the country, were included. Thus, these 27 reviewed papers were collected from Amhara (8 publications), Oromia (9), Souther Nations and Nationalities of Peoples (SNNP) (3), Tigray (3), Somalia (2), and Benshangul-Gumz (2) regional states of the country for screening the important medicinal plants (Figure 1). The inclusion of these publications enabled the authors to cover the important medicinal plants at the national

level, Ethiopia. The remaining references (24) were accessed or collected from Ethiopia and other countries as supplementary information for the chapter (but not for screening important medicinal plants). Thus, valuable data on medicinal plants such as name of family, genus, species and local names of the plants, and their parts used, uses, habits, habitats and regional distributions were carefully assessed, extracted, and tabulated in an excel spread sheet. These data were analyzed using descriptive statistics.

3. Important Medicinal Plants of Ethiopia and Their Uses

Ethiopia is endowed with a rich diversity of flora due to the different agroclimatic conditions of the country. Thus, the flora collection of Ethiopia comprises more than 6,500 species of vascular plants; of which, about 12% are endemic and 887 species are used as medicinal plants. Other studies reported that approximately 800 species of the medicinal plants are grown in Ethiopia, which are used for treating about 300 medical conditions. Hence, the medicinal plants are very important to offer the people with traditional medicines, which are used to treat various human and livestock diseases. Furthermore, these medicinal plants are beneficial in the economical uses through providing food, fodder, fuel wood and other raw materials. Moreover, medicinal plants provide ecological services by preventing soil erosion, flooding and climate change. About 80% of Ethiopian people rely on traditional medicine for their health care, especially where modern public health services are not accessible or limited. Additionally, about 90% of livestock population in Ethiopia relies on treatment of medicinal plants for primary health care. The major reasons why medicinal plants are in demand are due to (i) the trust the communities have in the medicinal values of traditional medicine and (ii) relatively low cost compared to modern medicine. Further, (iii) rural dwellers prefer traditional medicines because of their close proximity to the traditional healers. Moreover, (iv) the healers understand the patients, and their culture and environment better as well. Finally, (v) there is a lack of access to western medicine, especially in the rural areas of the Sub-Saharan countries including Ethiopia.

3.1. Important Medicinal Plants

In the context of this chapter, important medicinal plants can be defined as plants that are largely utilized by communities and reported frequently (cited at least in three articles) by scholars with their high fidelity level of medicinal values, besides their socio-economic benefits. Accordingly, 60 important medicinal plant species belonging to 57 genera and 40 families are presented in Appendix 2. Regarding the dominant families of the important medicinal plant species, Solanaceae (4) followed by Asteraceae, Fabaceae, Cucurbitaceae, Lamiaceae, and polygonaceae (each with 3 species) distributed widely and abundantly, among others are considered in the flora area. This was evidenced from reports of ethnobotanical surveys on the medicinal plant families of Ethiopia. Furthermore, the wide use of species from these families could relate to the existence of effective bioactive ingredients against ailments.

In present chapter, of the total important medicinal plants reviewed, ten top plant species were further screened, as rated in Appendix 2, in order have detail descriptions about their habits, habitats, distributions, plant parts, and uses. This rating could also be helpful to give conservation priority to these species by the concerned private and

government sectors. Therefore, the discussions were made on these 10 specific medicinal plants. These medicinal plants are largely used by local communities for different disease treatments in different parts of the country.

The top ten important medicinal plants used for treating various human diseases are
- *Ocimum lamiifolium* Hochst. ex Benth ("Damakesie" in Amharic, a national language of Ethiopia),
- *Vernonia amygdalina* Delile (bitter leaf),
- *Allium sativum* L. (garlic),
- *Ruta chalepensis* L. (rue),
- *Lepdium sativum* L. (garden cress),
- *Hagenia abyssinica* (Bruccie) T.F.Gmel ("Kosso"),
- *Calpurnia aurea* (Ait.) (Cape laburnum),
- *Carica papaya* L. (papaya),
- *Olea europaea* L. subsp. *cuspidata* (Wall. ex G. Don) (African wild olive tree) and
- *Croton macrostachyus* Hochst. ex Delile (broad-leaved croton)

(see Appendix 2).

These important medicinal plants are described in detail in the following (see section 1.3.4). Moreover, other important medicinal plants, which are commonly used by Ethiopians, but less frequently reported compared to the first ten top ones, include
- *Justicia schimperiana* (Hochst. ex Nees) T. Anders. ("Sensel"),
- *Carissa spinarum L.* ("Agam"),
- *Cucumis ficifolius* A. Rich ("Yemdir Embuay"),
- *Zingiber officinale* Roscoe ("Zinger"),
- *Asparagus africanus* ("Yeset qest") and
- *Phytolacca dodecandra* L'Herit.) ("Indod") (Appendix 2).

Growth form: While considering the growth form of these important medicinal plants (Table 1), shrubs (25 species) are dominant followed by herbs (12) and trees (12), whereas climbers (4) are the least one. However, in other references while reviewed, herbs of medicinal plants are dominant followed by shrubs and trees. This might be due to the screening of only the important medicinal plant species among other species.

Habit	Frequency
Shrubs	25
Herbs	12
Trees	12
Trees/shrubs	7
Climbers	4

Table 1. Habit distribution of important medicinal plants in Ethiopia

Plant parts used: Leaves, roots, seeds, fruits, bulbs, barks, and flowers of medicinal plants have medicinal values. Thus, one or the combination of two or more of these can be used for preparations of traditional medicines. As presented in Table 2, roots are dominant parts of the majority of plants (17 species, 28.33%) used alone for the

preparation of remedies. It can also be used in combinations with other parts such as with seed, bulb or leaf. Leaves are the second most used part of these important medicinal plants (15, 25%) in treating various human diseases. It can also be used in combinations of other plant parts such as with root, bark, fruit or stem together (9, 15%). Therefore, harvesting the entire root parts of a large number of important medicinal plants (28.33%) along with the leaves of many plants (15%) for the preparations of traditional medicines presents the threat of survival for such medicinal plants at country level.

Plant parts	Frequency
Stem	1 (1.67%)
Seed/ Leaf	1 (1.67%)
Seeds	4 (6.67%)
Root/ Seed	1 (1.67%)
Root/ Bulb	1 (1.67%)
Root	17 (28.33%)
Leaf/ Root	5 (8.33)
Leaf/ Bark	2 (3.33%)
Leaf/ Fruit	1 (1.67%)
Leaf/ Stem	1 (1.67%)
Leaf	15 (25%)
Fruit/ Seed	4 (6.67%)
Fruit	1 (1.67%)
Flower	1 (1.67%)
Whole	2 (3.33%)
Bulb	3 (5%)

Table 2. The frequency of medicinal plant parts used for preparation of traditional medicines

3.2. Uses of Important Medicinal Plants

Plants are the most essential to human welfare by providing basic human needs. Medicinal plants mainly contribute for traditional health care, and are sources for new drug development. Additionally, they are important in generating incomes to the local communities, or in providing economical values besides maintaining their habitats/ecology, as described in detail in the following sub-topics. Thus, these plants play crucial roles in daily life and highly associated to the diverse socio-cultural and economic events.

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