



Bioprospecting Potential of Medicinal Plants in Borena and East Shewa Zones of Oromia Region, Ethiopia

Girum Faris*¹, Nigussie Seboka²

^{1,2}Ethiopian Biodiversity Institute, Access and Benefit Sharing Directorate, Ethiopia

*Corresponding author: girumf@gmail.com

Abstract

Plants have many novel secondary metabolites with antimicrobial properties that protect themselves against infection. These properties are usually effective against a broad range of possible infectious agents of humans and animals. This study aimed to investigate the Bio-prospecting potential of some selected plants in Borena and East Shewa Zones of Oromia Region of Ethiopia for access and benefit sharing. Data was collected using semi-structured questionnaire. Informants were selected using purposive sampling technique, based on their traditional healing practice, use of aromatic plants and/or their derivatives for different purposes in the study area. For each plant species, the informants were asked to explain its therapies, preparation methods, diseases claimed to be treated, used part of the plant, routes of administration, mode of preparation, and the local name of the species and its use. A total of 37 plant species were identified and recorded as source medicine to prevent, control and treat diseases and harmful animal venoms like snakes. *Solanum incanum* is the most frequently used medicinal plant species in the studied area, and followed by *Melia azedarach*, *Ocimum urticifolium* and *Echinopskebericho*. The respondents use these plants mainly for the purpose treating, controlling and preventing ailments such as gastro intestinal infection, malaria, snake venom, ectoparasites, cancer and excessive bleeding. Similarly, *Datura stramonium*, *Ebelia schimperi*, *Euphorbia tirucalli*, and *Tagetes minuta* are also among the most commonly used aromatic plants those were mentioned by respondents. Respondents use these plants to control, prevent and treat ailments such as fungal infection, intestinal parasites, disease transmitting vectors, and external parasites. Therefore, because of their prospect for the production of many pharmaceuticals products, bio prospecting companies require to access the genetic resources following the Ethiopian legislation of Access and Benefit Sharing.

Keywords: Antimicrobial properties, Bio-prospecting, Aromatic plants, Infection

1. Introduction

Plants have many novel secondary metabolites with antimicrobial properties that protect themselves against infection. These properties are usually effective against a broad range of possible infectious agents of humans and animals. Some clinical epidemiological studies are in support of this and many laboratory investigations (David *et al.*, 2010) have suggested the presence of heterogeneous antimicrobial compounds extractable using different chemical procedures. A few recent

studies have identified some of the active antimicrobial compounds (Hugues, 2009).

Medicinal plants and traditional medicine play an important role in the health care system of most developing countries like Ethiopia. The traditional health care practice is mainly dependent on medicinal plants collected from the wild and home garden. In spite of this, the medicinal plant biodiversity is being depleted due to man-made and natural disasters. Moreover, the indigenous knowledge associated with

the conservation and use of medicinal plants is also disappearing at an alarming rate (Singh, 2001).

Antibiotic treatment is not only expensive but also has less effect on immune-suppressed. It is also not a realistic option for the under-privileged. A segment of Ethiopian residents were too poor to be sick and cannot spare their revenue in long queues. Therefore, it is wise to promote accessible and acceptable measures to nurture and manage the health problems of Ethiopian inhabitants (Ebrahim, 2003). Accordingly providing benefit to local populations and often their associated ecosystems with style of ethnobotanical research has become a primary objective (Salick, 2003; Cunningham, 2008).

The resistance development by pathogens to the existing pharmaceutical has led to the intensification of the search for novel drugs, against fungal, parasitic, bacterial, and viral infections. Plant-derived antimicrobials have a long history of providing the much needed novel therapeutics. A number of traditionally used medicinal plants have so far been screened for various biological activities in both *in vivo* and *in vitro* models. Chemical investigation of the medicinal plants intended to have medicinal properties has yielded numerous purified compounds which have proven to be indispensable in the practice of modern medicine (Ncube *et al.*, 2012).

Ethiopia has a great potential for biodiversity and wealth of traditional knowledge accumulated by local people who have direct access to nature and the products of biodiversity. There has been increasing interest in acquiring knowledge regarding the medicinal plants within the study area, and some publications describe the rich flora of this area as having many medicinal purposes (Asfaw Tora *et al.*, 2015). Bioprospecting is the process of discovery and commercialization of new products based on biological resources and indigenous knowledge.

Despite an indigenous knowledge being intuitively helpful, bioprospecting has only recently begun to incorporate such knowledge in focusing screening efforts for bioactive compounds (Cluis, 2013). From this observation, as a baseline, the essential extracts from those medicinal plants used by the local people of the study area might have an industrial application which is not properly and systematically utilized currently in Ethiopia. Therefore, this study is designed to meet the following specific objectives to document indigenous knowledge of aromatic plants in the study area and promote the identified potential medicinal plants for bioprospecting.

2. Materials and Methods

2.1 Study Area

The study was carried out in East and Southeast directions of Oromia Region. The areas includes Borena Zone which is located in 3°26'–6°32' N longitude and 36°43'–40°46'E latitude extending for about 331.6 km north to south and 442.06 km east to west. The zone shares common boundaries with Somali Region in southeast, Southern Nations, Nationalities and Peoples' Region. Of the total districts three districts namely Yabelo, Elwaye & Gamole districts were selected for this study.

East Shewa is located in the middle of Oromia with 7.3578° N, longitude 38.4850° E, latitude connecting the western regions to the eastern ones. This zone is bordered by the West Arsi Zone, Nations, Nationalities and Peoples Region; South west Shewa and Oromia Special Zone Surrounding Finfinne Amhara Amhara Region. Similarly Lume district is selected by Agricultural office recommendation purposely based on the availability of medicinal plants in the zone.

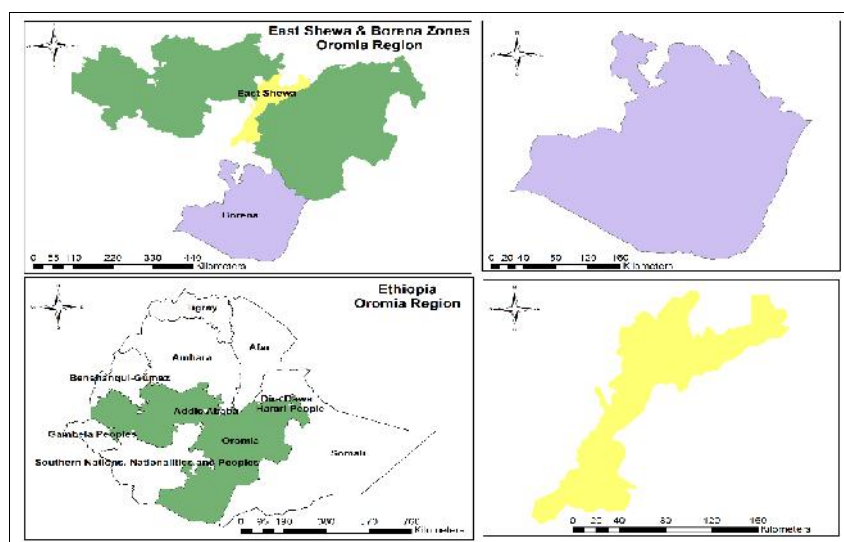


Figure 1: Map of the study areas

2.2. Data collection

Following Martin (1995), basic information about the informants was collected from Borena and East Shewa Zone Agricultural Offices, Districts and Kebeles. Further information about the target groups and key informants also gathered from community leaders, knowledgeable elders, health workers and extension agents. Based on the information and following purposive sampling technique, informants were selected using their traditional healing practice, use of aromatic plants and/or their derivatives for different purposes in the study area.

2.3. Ethno-botanical Data Collection

Data was collected using semi-structured questionnaire from Borena and East Shewa Zones and from 4 purposively selected districts. The selection criteria for target groups were history of traditional medicine practitioner, experience of using medicinal plants for different purpose and years of previous stay in the area. The questionnaires were prepared in English and then translated into local language. The processes were administered with the help of local interpreters who were well educated and able to understand the questionnaires as well as the objectives of the study.

For each plant species, the informants were asked to explain its therapies, preparation methods, diseases claimed to be treated, used part of the plant, routes of administration, mode of preparation, and the local

name of the species and its use. The information regarding the use of a particular species for a specific purpose will be treated as one user report. Walk from any direction was made with each informant into their surroundings from where they collect the plants. During this walk, plant specimens and samples for lab analysis were collected.

2.4. Plant Sample Collection

The reported medicinal plants were collected from natural vegetation and home garden. Sample specimens of the plants cited for their medicinal or aromatic uses were collected, numbered, pressed and dried for lab analysis. The collected specimens were taxonomically identified by taxonomists at Ethiopian Biodiversity Institute. Voucher specimens are deposited in the Herbarium of Ethiopian Biodiversity Institute.

2.5. Data Analysis

The data gathered from the informants was analyzed using descriptive statistics. Microsoft Excel spreadsheet software and SPSS version 21 were used to analyze all the data:

3. Results and Discussion

3.1. Demography

A total of 66 respondents (59 [89.4%] males and 7[10.6%] females) were interviewed during the study period. Their age varied between 30 years (the minimum age) and 90 years (the maximum age) with age mean of 56.32±14.19. The study involved 45(68.2%) traditional healers from Borena zone and 21 (31.8%) from East Shewa zones based on their willingness to share their knowledge. All of them are married, and regarding to their position in household, 62 (93.9%) of them were household while the

remaining 4 (6.1%) of the respondents were spouse and had attended either primary or secondary school education.

3.2. Most common Human diseases in the study area

According to informants’ consensus, malaria and gastrointestinal diseases are the most troublesome health problem of human in the study area. The weekly report of Ethiopian Public Health Institute confirms this informants’ agreement on the high prevalence of these diseases in the studied areas (EPHI, 2016) (Table 1).

Table 1: The most common human diseases in the study area

	Frequency	Percent	Valid Percent	Cumulative Percent
Valid				
Common cold, Malaria	7	10.6	10.6	10.6
Coughing, Malaria	4	6.1	6.1	16.7
Diarrhea	3	4.5	4.5	21.2
Evil eye, Malaria	1	1.5	1.5	22.7
Food borne diseases	1	1.5	1.5	24.2
Gastric	2	3.0	3.0	27.3
Gastrointestinal	2	3.0	3.0	30.3
Gastrointestinal, Malaria	17	25.8	25.8	56.1
Kidney	1	1.5	1.5	57.6
Malaria	12	18.2	18.2	75.8
Respiratory disease	11	16.7	16.7	92.4
Sanitation problems	1	1.5	1.5	93.9
Skin diseases	2	3.0	3.0	97.0
STD	1	1.5	1.5	98.5
TB	1	1.5	1.5	100.0
Total	66	100.0	100.0	

3.3. Mechanisms of preventing diseases transmitting insects in the study area

Study participants use different mechanisms to prevent disease transmitting animals. From the total informants 65.1% of them agreed that they used smoking different plant species like ‘Etan’, and ‘Kebericho’ to prevent animal vectors diseases. More than 34% of the informants agreed that they had faith in fumigation, medication, chemicals and using aromatic plant like ‘Nime’ as mechanisms to prevent diseases transmitting animals.

3.4. Knowledge of using medicinal plant in the study area

Sixty three (95.5%)of respondents confirmed their use of aromatic medicinal plants from their surrounding for different purposes, particularly to treat diseases and prevent diseases transmitting insects including animals those are dangerous because of their venom secretion. Only 3, 4.5% respondents confirmed as they did not use them for medicinal purposes. More than 50% of the respondents agreed that they used aromatic plants for their medicinal values. The respondents also mentioned that they used these plants for fumigation, to repel harmful insects and animals and treat diseases.

3.5. Aromatic plants used by healers to treat diseases

Totally 37 plant species were identified and recorded as source medicine to prevent, control and treat diseases and harmful animal venoms like snakes. *Solanum incanum* is the most frequently used aromatic plant species in the studied area, and followed by *Melia azedarach*, *Ocimum urticifolium* and *Echinopskebericho*. The respondents use these plants mainly for the purpose treating, controlling and preventing ailments such as gastro intestinal infection,

malaria, snake venom, ectoparasites, cancer, excessive bleeding and others listed in table 2. Many studies reported that these plants have immense bio-prospecting potential due to their wide spectrum of pharmacological activities and due to their uses to treat various ailments that include; sore throat, angina, stomach ache, ear inflammation, snake bites, wounds, liver disorders, skin ailments (ringworm), warts, inflammatory conditions, painful periods and fever (Khaki *et al.*, 2011; Mwonjoria *et al.*, 2014; GemechuAmeya *et al.*, 2016; Shekhawat *et al.*, 2017).

Table 2: List of plants used by respondents to treat ailments

Local name	Scientific name	Disease	Frequency	%
Aemu	<i>Sida schimperiana</i>		1	0.76
Aloe spp	<i>Aloe yavellana</i>		1	0.76
Amaresa	<i>Acacia brevispica</i>		1	0.76
Atefaris	<i>Datura stramonium</i>		6	4.58
Bakanisa	<i>Croton macrostachyus</i>		3	2.29
Barsafi	<i>Eucalyptus spp</i>		2	1.53
Birresa	<i>Terminalia brownie</i>		2	1.53
Debobesa	<i>Dalbergia melanoxylon</i>		1	0.76
Dhame	<i>Schrebera alata</i>		1	0.76
Dhumayo	<i>Maerua triphylla</i>		2	1.53
Diqa	<i>Pappea capensis</i>		1	0.76
Dobiarba	<i>Cyphostemma adenocaulis</i>		2	1.53
Eslale	<i>Ferula communis</i>		1	0.76
Gada	<i>Zanthoxylum usambarensis</i>		2	1.53
Garlic	<i>Allium sativum</i>		1	0.76
Grawa	<i>Vernonia schimperi</i>		2	1.53
Hamarasa	<i>Acacia brevispica</i>		1	0.76
Hanqu	<i>Ebelia schimperi</i>		6	4.58
Hargesa	<i>Aloe yavellana</i>		2	1.53
Haroresa	<i>Grewia trichocarpa</i>		2	1.53
Hiddi	<i>Solanum incanum</i>		50	38.17
Homboroka	<i>Lanearivae</i>		1	0.76
Kase	<i>Ocimumurticifolium</i>		8	6.11
Kulkualspp	<i>Euphorbia schimperiana</i>		2	1.53
Lubukekebi	<i>Senna didymobotrya</i>		3	2.29
Mie'sa	<i>Euclea racemose</i>		2	1.53
Moringa	<i>Moringa stenopetala</i>		6	4.58
Neem	<i>Melia azedarach</i>		13	9.92
Qebericho	<i>Echinopskebericho</i>		7	5.34
Qiltipe	<i>Barleriaer anthemoides</i>		1	0.76
Qinchib	<i>Euphorbia tirucalli</i>		5	3.82
Qundoberbere	<i>Piper nigrum</i>		2	1.53
Robi	<i>Hermaniasp</i>		1	0.76
Sulisa	<i>Ocimumspp</i>		1	0.76
Sunki	<i>Tagetes minuta</i>		5	3.82
Tenadam	<i>Rutacha lepensis</i>		4	3.05
Wale	<i>Physalis peruviana</i>		3	2.29
Total			131	100.0

Similarly, *Datura stramonium*, *Ebelia schimperi*, *Euphorbia tirucalli*, *Tagetes minuta* are also among the most commonly used aromatic plants those were mentioned by respondents. Respondents use these plants to control, prevent and treat ailments such as fungal infection, intestinal parasites, disease transmitting vectors, and external parasites. The repellent activities of essential oil of these plants particularly *Tagetes minuta* traditionally is used in some part of the world to control ectoparasites. The scientific rationale for traditional use of raw products of these plants in controlling livestock ticks by the Bukusu community and lay down some groundwork for exploiting partially refined products such as

essential oils of these plants in protecting cattle against infestations with *R. appendiculatus* is provided by Wanzala *et al.* (2014).

3.6. Aromatic plants cultivation by respondents

Of all the respondents 24.2% of them did cultivate some aromatic medicinal plants, while 75% of them did not cultivate aromatic medicinal plants. The respondents mentioned many reasons for why they did not cultivate the medicinal plants, and the majority of the respondents mentioned that they can easily get from the wild therefore they do not want to cultivate the plants (Table 3).

Table 3: Status of aromatic medicinal plants

	Frequency	Percent	Valid Percent	Cumulative Percent
Valid Available in wild	46	69.7	69.7	69.7
Cannot be cultivated	2	3.0	3.0	72.7
gardening few of them	11	16.7	16.7	89.4
Not allowed	1	1.5	1.5	90.9
Skipped	1	1.5	1.5	92.4
Access easily	4	6.1	6.1	98.5
very rare	1	1.5	1.5	100.0
Total	66	100.0	100.0	

3.7. Storage conditions

From the total respondents, 83% of them stored the prepared aromatic medicinal plants at dry area using clean container. However, few of them claimed that the prepared medicine should not be stored and it should be given to the patients as soon as it is prepared (Table 4).

Table 4: Storage conditions for prepared medicinal plants

	Frequency	Percent	Valid Percent	Cumulative Percent
Valid Dry area	58	87.8	87.8	87.8
Not stored	5	7.6	7.6	90.9
Under water	3	4.5	4.5	100.0
Total	66	100.0	100.0	

3.8. Current status of aromatic medicinal plants and demands as medicine

Majority of the respondents indicated that the status of aromatic plants was increasing and their demands by the user to treat as well as to prevent diseases are also increasing from time to time (Table 5).

Table 5: Status, demands of aromatic medicinal plants

		Frequency	Percent	Valid Percent	Cumulative Percent
Status	Decreasing	59	89.4	89.4	89.4
	Remain the same	7	10.6	10.6	93.9
	Total	66	100.0	100.0	100.0
Demand to treat diseases	Decreasing	10	15.2	15.2	15.2
	Increasing	49	74.2	74.2	89.4
	Remain the same	7	10.6	10.6	10.6
	Total	66	100.0	100.0	100.0
Demand to prevent diseases	Decreasing	6	9.1	9.1	9.1
	Increasing	54	81.8	81.8	90.9
	Remain the same	6	9.1	9.1	9.1
	Total	66	100.0	100.0	100.0

3.9. Threats posed on aromatic plants and means of conservation

All the respondents agreed that there were threats on aromatic medicinal plants because many reasons. The major factors were agricultural expansion, Climate change, practices, fire, deforestation, over population, deforestation, urbanization and over exploitation. However, the majority of them had no idea about how they should conserve these plants for their sustainable utilization.

3.10. Inheritance of healing practice

More than three fourth of the respondents inherited their traditional knowledge from their father. And they wanted to inherit their knowledge to their child, but only a few respondent had no interest of inheriting their knowledge to anybody. This could be a reason that the knowledge behind medicinal knowledge is depleted from time to time.

4. Conclusions and Recommendations

In conclusion the use of aromatic medicinal plants are being used frequently in the study areas for different purposes, particularly to treat diseases and prevent diseases transmitting insects including animals those are dangerous because of their venom secretion.

Most respondents did not cultivate aromatic medicinal plants because of easy access from nearby forests. Currently there is a series change in the forest ecosystem because of massive forest clearing activities. The local people are highly dependent on traditional medication. However, the trend of medicinal plant threats has been increased in the last five year because of agricultural land expansion, overgrazing, overexploitation and deforestation. Therefore, all concerned bodies should act to tackle these problems the respected regional, Zonal and District government representatives has to be aware of in keeping and giving accreditation to local healers.

5. Acknowledgments

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