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Ethnobotany of medicinal plants used for making herbal teas in coastal Syria

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Declaration

I hereby declare that I have done this thesis entitled "*Ethnobotany of medicinal plants used for making herbal teas in coastal Syria*", independently, all texts in this thesis are original, and all the sources have been quoted and acknowledged by means of complete references and according to Citation rules of the FTA.

In Prague, April 27th, 2018

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Naji Sulaiman

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Abstract

Syria is a Mediterranean country located on a connection geographical point of three continents, Europe, Asia, and Africa, where diversity of cultures has been mixed together along the history. The area between Mesopotamia and Mediterranean is an old and rich region in folk medicine knowledge, but there is a lack of studies to document this knowledge. Our study was carried out in the north-western part of Syria bordering the Mediterranean Sea with 193 km including coastal plains and mountains up to 1,500 m above sea level. The study focuses on ethnobotanical documentation of medicinal plants used in the form of a tea as well as an analysis of significant part of beverage culture of the local people, which includes herbal teas used for both medicinal and recreational purposes. Between December 2017 and February 2018, 42 informants from 32 geographical points distributed along the study area were interviewed. In total, 49 medicinal plant species were reported to be used in the form of a tea. In total, we received 303 use reports, which were categorized into 13 ailment categories. Although most of the plants investigated were used separately, 26 kinds of herbal mixtures used for making teas were documented. The data were analysed through calculation of the species Use Value, Informant Agreement Ratio, and Cultural Value Index. Use value index was calculated to give a numerical value to using of the plant species, Informant Agreement Ratio was calculated to let us know the agreement between informants' reports, while the Cultural Value Index showed us the most important species which could indicate the species with promising economic value.

The study lead to better understanding of folk medicine in the study area, moreover, it contributed to documenting the diversity of medicinal plant species used as a tea, additionally, our study highlighted some important species for the future pharmacological studies which could be done.

Keywords: Ethnobotany, folk medicine, herbal mixtures, herbal tea, infusion, recreational tea, Syria.

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List of abbreviations:

B.C	Before Christ
CBD	Convention on Biological Diversity
CV	Cultural Value Index
FAO	Food and Agriculture Organization of the United Nations
FC	Frequency of Citation
GDP	Gross domestic product
IAR	Informant Agreement Ratio
m.a.s.l	Metres above sea level
UN	United Nations
UNDP	United Nations Development Program
UNHCR	United Nations High Commissioner for Refugees
UR	Use Report
USD	United States Dollar.
UV	Use Value
WFB	The World bank
WHO	World Health Organization

1. Introduction and Literature Review

1.1. Overview of Syria: geography, history and societies

Syria is officially known as the Syrian Arab Republic, it is on the eastern side of the Mediterranean Sea and covers 185,180 km2. it shares borders with 5 countries, Turkey on the north, Iraq on the east and southeast, it shares the south border with Jordan, Palestine on the southwest, and Lebanon located on the west side (Skeiker 2009). During a long period of history, it was known as Greater Syria, or the Levant (Bilad al-Sham), this region included nowadays the current states Syria, Lebanon, Jordan, and Palestine/Israel, as well as a portion of southern Turkey. In its current form, Syria occupies the northern part of the Greater Syria (Pipes 1992). It lies between latitudes 32° and 38° N, and longitudes 35° and 43° E. The north-western part of the country bordering the Mediterranean Sea with 193 km coastline starts at Lebanon's northern border and runs to the southern border of Turkey (Kasparek 1995), the north-eastern part of the country is "al-Jazira", and the South part of the country "Hawran" are important agricultural areas, while the rest country space is arid or semi-arid areas (Miller 1919). There are three big rivers in Syria, which form around it floodplains fertile for agriculture, the river Orontes (al-Asi river) springs from Lebanon and heading north in Syria forming Ghab basin (Bridgland et al. 2012). In the north-eastern part of Syria, there are Euphrates and Tigris rivers and its tributaries which served as the cradle for many civilizations that have been established in Mesopotamia. The Euphrates is flowing through in Syria with 680 km and Tigris with 50 km, forming together what is so called in Syria "al-Jazira" which means island in English (Altinbilek * 2004), "al-Jazira" considered in heart of the Fertile Crescent (Lev-Yadun et al. 2000).

The capital of Syria Damascus is one of the oldest cities in the world it has been continuously inhabited, many civilizations have left their marks over centuries, such as Aramaic, Romans and Ottomans and lastly the Arabs (Mattit et al. 2006). The earliest recorded indigenous civilization in the region was the Kingdom of Ebla northern Syria. it has been founded around 3500 BC (Gelb 1977). Ugarit also arose 1800 BC close to modern Latakia, The Ugaritic alphabet considered to be the world's earliest known alphabet (Healey 1990), And from this area a Canaanite group known as the Phoenicians came to dominate the coasts of Syria and Lebanon and northern Palestine from the 13th

century B.C, founding city states such as Amrit, Arwad (the only island in the eastern Mediterranean) and Byblos. From these coastal cities, they eventually spread their influence throughout the Mediterranean, including building colonies in Malta, Sicily, the Iberian Peninsula (modern Spain and Portugal), as well as the coasts of North Africa (Markoe 2000).

On the demographic side of Syria, the population statistics according to World Bank data in 2010 was 21 million people, that was before the Syrian war and what followed with a huge number of the Syrian refugees, the newest number was in 2016 estimated according to the same source to be about 18.4 million people. 54% of them live in urban areas while 46% in the rural areas, the annual gross national product of the agriculture sector reach in 2010 up to 7 billion USD (The World bank 2016). In Syria there are diverse ethnic and religious groups, ethnicities include Arabs, Greeks, Armenians, Assyrians, Kurds, Circassians, and Turkmans. While religious groups include Sunnis, Christians, Alawites, Druze, Isma'ilis, Shiites, Salafis, Yazidis, and Jews. Sunni makes up the largest religious group in Syria (Gammer 2004). There are many languages spoken in Syria, Arabic as the official language, Kurdish, Armenian, Aramaic, and Caucasian, while the French, English spoken by educated people. The Aramaic is still spoken by an estimated some villages situated north of Damascus, the Aramaic was the official language in Syria till Umayyad caliphate established in the 6th century in Damascus when they replaced the Aramaic language by the Arabic one (Gelfand 2013).

Economically, Syria depends on the oil and agriculture sectors, where the agriculture sector is contributing some 20 percent to its GDP, and it is involving 17 percent of its labor force. Prior to the current circumstances and displacement which happened during the war, 46 % of Syrians were rural dwellers, and of these about 80 percent derived their livelihood from agriculture (WFP 2013; The World bank 2009). In March 2011 a war started in Syria because of many complex interrelated factors, and it is according to (Gleick 2014) connected to some natural reasons, Starting in 2006, and lasting into 2011, Syria faced a multiyear period of extreme drought that contributed to agricultural failures, economic dislocations, and population displacement (Worth 2010), This dry period described as the “worst long-term drought and most severe set of crop failures since agricultural civilizations began in the Fertile Crescent many millennia ago” (Femia & Werrell 2012).

1.2. Natural conditions and vegetation in Syria

Syria's climate is the prevalent Mediterranean, characterized by rainy winters, dry summers, and two short transitional seasons of fall and spring. The humidity ranges between humid on the Mediterranean coast, semiarid steppe zone, and the arid desert regions. The average temperature in summer is 32 °C, in winter 8 °C, and 22 °C in spring and autumn (Syrian investment agency 2011). The topography in Syria demonstrates a significant diversity and it consists of four main regions that form different ecosystems, if we start from the west we find the coastal plain bounded by mountains to the immediate east, a narrow plain run along Syria's Mediterranean coast from Turkey in the north to Lebanon in the south. The width of the plain varies depending on the reach of the nearby mountains, the plain is widest in the north near the city of Latakia as well as in the south near the Lebanese border. due to its extremely fertile soil and Mediterranean climate, the coastal plain is the site of intense agriculture. It is also densely populated. The terrain along the coastline varies from sandy shores to rugged, rocky promontories and cliffs (Dougherty 2004).

The second region is the mountains, a chain of mountains called the mountains of Alawite or Jabal AN Nusayriyah, it rises from the coastal plain to form a rugged north-south boundary running parallel to the coast. The peaks of the Alawite mountains average is 1,212 m, the highest peak is the Prophet Younus mountain with 1,524 m in the northern part of the range (Behnke 2005). The range's western slope, indented with deep ravines, receives significant moisture from the Mediterranean Sea. The range's eastern slope descends rapidly into the richly fertile Ghab basin (Carter & Dunston 2004). To the south of this range, there is what is known as Homs gap which allows the rain-bearing clouds from the Mediterranean pass through to the interior areas, if we continue to the south there are the Anti-Lebanon Mountains form the boundary between Syria and Lebanon. running more to the south we find Jabal al-Shaykh, also known as Mt. Hermon 2,814 m. Additional ranges populate the southern and central areas of Syria, another range is Jabal al-Arab which known as the Jabal Druze, most of these mountains are often capped with snow in winter months. From Mt. Hermon, the range descends southward into the Israeli-occupied Golan Heights region (Encyclopedia Britannica Online 2008). To the East of the western mountains and the Ghab basin we find two overlapping areas of arable plains and Syrian desert, it largely consists of semiarid to arid plateau, with vegetation ranging

from agricultural crops to grass and shrub. In the north and northeast, the Euphrates River and its tributaries intersect the plateau and carry precious water through the region, allowing for agricultural development and human settlement. The far northeastern region of Syria is al-Jazira plain which located between the Euphrates and Tigris Rivers as mentioned before, this expanse of grassland is an important agricultural region, particularly for cereal crops, this area is the northern region of Mesopotamia (Ball 2007). Moving south from the Euphrates River Basin, the terrain transitions from steppe into the Syrian Desert, which comprises most of southeastern Syria, the terrain in this region is dry, rocky, and largely barren, although there are occasional oases and some patches of scrub grass, like Palmyra (Dougherty 2004). The mean annual rainfall in the coastal plains is 920 mm, while it reaches up to 1200 mm in the coastal mountains, with going inside the country it declines to 530 mm in al-Jazira, and to 150 mm only in the steppe region (Ehrman & Cocks 1990).

West Asia, in general, has long been recognized as the center of origin for many important crops (Vavilov 1926), Syria is a home for more than 3500 species belonging to 865 genera in 131 families have been found in Syria (Bouloumoy 1930), there are various vegetation zones, In the west of the country, mild wet winters and hot dry summers provide ideal conditions for the Eastern Mediterranean conifer-sclerophyllous-broadleaf forests of the region which include evergreen oaks, Aleppo pines, and other conifers. Where the trees have been removed for timber, sclerophyllous shrub predominates, such as maquis shrubland, and garrigue in calcareous areas (Gockel & Bruns 1998). At the beginning of the 20th century, forests covered about one third of the country, but now, this has reduced to about 3% (Global environmental faculty 2009), The remaining forest cover is mostly in the Syrian Coastal Mountain Range and consists of thorny and glossy-leaved trees such as *Myrtus communis* L., terebinth, strawberry tree and wild olive (Gockel & Bruns 1998). Plants found in the semi-arid and arid regions include bulbous plants such as *tulips, fritallaries, Asphodeline damascena, Asphodeline lutea, crocus, iris, Drimia maritima, Colchicum hierosolymitanum* and *Asphodelus aestivus*, and other plants such as *Papaver dubium, Papaver rhoeas, Malva parviflora, Plantago ovata, Plantago coronopus, Paliurus spina-christi, Ziziphus lotus, Adonis aleppica, Adonis palaestina* and *Eryngium maritimum,* those dwarf shrublands and annual grasses have provided food not only for domestic livestock (sheep, goats and camels), but also for wild herbivores (gazelles, oryx, onagers, ostriches). (Goodin & Northington 1985). In

agriculture, there are some economically important species for example in the coastal plains is orange with production in 2010 reached up to 668,900 tons and olive with 960,403 tons annually. The production of grape concentrated in "Hwaran" plains with 325,700 tons, while apple production is 393,100 tons per year. The highest vegetable production is in tomato with 1,156,300 tons annually, then potato with 673,200 tons. Cereals are produced mainly in "al-Jazira" plains, the production of wheat in 2010 was more than 3 million tons (Central Bureau of Statistics 2011).

1.3. Traditional medicine in The Middle East and Syria

Traditional medicine has been defined by the WHO as: It is the sum total of the knowledge, skill, and practices based on the theories, beliefs, and experiences indigenous to different cultures, whether explicable or not, used in the maintenance of health as well as in the prevention, diagnosis, improvement or treatment of physical and mental illness. Traditional medicines that proven safety and efficacy, participate to the objective of ensuring that all people around the world have access to care. Approximately 80% of the world's inhabitants rely mainly on traditional medicines for their primary health care. Herbal medicines, traditional treatments, and traditional practitioners are the main source of health care for many millions of people, and sometimes the only source of care. This kind of care is accessible and affordable. It is also culturally acceptable and trusted by large numbers of people (WHO 2013). The Middle East in general, is represented by a rich spectrum of indigenous traditional schools of medicine modelled on a mixture of social, religious, and spiritual perspectives (Ben-Arye et al. 2012). The first records of traditional medicine were written on clay tablets in cuneiform in Mesopotamia and date from about 2600 BC. Among the substances which the Mesopotamian communities used, were oils of the *Cedrus, Cupressus sempevirens* species, *Commiphora* species, *Glycyrrhiza glabra*, and *Papaver somniferum*, which most of these plants are still in use today for the treatment of ailments ranging from coughs and colds to parasitic infections and inflammation. Egyptian pharmaceutical record is the "Ebers Papyrus" dating from 1500 BC. This document some 700 drugs (mostly plants), and includes formulas, such as gargles, snuffs, poultices, infusions, pills, and ointments, made with beer, milk, wine, and honey as vehicles (Cragg & Newman 2001). After the fall of the Roman Empire, the Arabic world was the centre of scientific and medical knowledge, texts from Greece and Rome were translated into Arabic and studied by Arabic scientists (Azaizeh et al. 2006).

After that pharmacologists and ethnopharmacologists started to search deeply for different ingredients and extracts to be used as medicine and studied the chemical properties of materials used in disease management. At that time, the scientist in chemistry and pharmacy Jabir Ibn Haiyan born in eastern Syria 721 A.D, and for the first time, he created methods to extract and purify different compounds such as alcohol, nitric acids, sulfuric acids (Bin Murad 1991). During 10th century Avicenna (Ibn-e-Sīnā) came as one of the most outstanding medical scientists and practitioners ever in the middle east, and he left a deep influence on medical science with his great medical manuscript, Al-Qanun-fi-al-Tibb (The Canon of Medicine/ The Law in Medicine) (Diamantis et al. 2010). in the period between 1197 to 1248 the greatest botanist and pharmacist Ibn al-Bitar who lived in Damascus published the book Food and Drinks which considered the most prestigious book in the Arabian pharmacopeia (Saad & Said 2011). The Eastern region of the Mediterranean has been distinguished throughout generations with a rich inventory of natural medicinal herbs used by local herbalists, 700 plant species in the Middle East were noted for their use as medicinal herbs or as botanical pesticides. Unfortunately, recent ethnopharmacological surveys revealed that around 200–250 plant species are still in use in Arab traditional medicine for the treatment of various diseases (Said et al. 2002). The medicinal, aromatic plants are directly collected by the rural population and the Bedouins in Syria to prepare traditional medicines, following the Unani system of medicine (Sincich, 2002). These plants are sold as well as in the markets of the large cities in Syria. The Unani Tebb (Unani in Arabic means Greece in English and Tebb means medicine) draws from the traditional systems of medicine of China, Egypt, India, Iraq, Persia and Syria. and It is also called Arabic medicine (WHO, 2001). Regulation of the herbal medicine in Syria established in 1998 in the same law that regulated the conventional pharmaceuticals, and currently there are 44 herbal medicines registered in Syria, usually, the herbal products are sold in “Attarah” shops (Saad & Said 2011). “Zhourat” (it is also known as “Zahraa” in Syria) is a traditional local herbal tea and beverage consumed by Lebanese, Syrian, Assyrian and Armenian rural populations in the Middle East. This drink is also consumed very often in cafes in major cities of Syria, Lebanon and nearby countries (Carmona et al. 2005). This herbal tea consists of a blend of wildflowers, herbs, leaves, and fruits. These are selected from over 70 species which are known for their treatment properties (Obón et al. 2014).

1.4. Previous ethnobotanical studies in Syria

Ethnobotany was a term suggested for the first time by John Harshberger in 1896 to delimit a specific field of botany and describe plant uses (Harshberger 1896). And according to Martin (2004) ethnobotany is the part of ethnoecology which concerns plants, and it is an interdisciplinary field involving botany, anthropology, ecology, linguistics and in some cases economy, ethnobotanists has defined the term ethnobotany for several times but in similar ways, principally they said that it is a study of the relationships between people and plants. There is an essential element in this discipline based on the knowledge of indigenous people in their interactions with plants (Turner 1995).

In Syria, there is a very lack of literature reporting in ethnobotanical studies, we could not find any static information about this kind of studies, so we did a deep and wide search by both English and Arabic languages in several websites for published papers such as Google Scholar (www.scholar.google.com), Web of sciences (www.webofknowledge.com), Scopus (www.scopus.com). We found only four ethnobotanical papers have been published, one of it in French, and two books in English dealt with the traditional medicine in specific areas in Syria, in the Arabic language we found some teaching materials for the Syrian universities which focusing on medicinal and aromatic plants in general. Regarding articles the first article has been done by Carmona et al. in (2005), it was about herbal tea used mainly in the capital city Damascus. The second paper was carried out in Aleppo city and done by Alachkara et al. in (2010) studied the folk medicine in the northern part of Syria, another study has been done about Beverage and culture in middle east, in this study Concepción et al. (2014) analysed ingredients of herbal tea mixtures collected from Damascus city, two cities in Lebanon, and Lebanese shops in Paris. According to best of our knowledge there is no any ethnobotanical study has been done in the coastal region of Syria or even there is no ethnobotanical paper has mentioned about it, and in this region, we did our study.

1.5. Statement of the problem

Every year there are 5.5 million hectares of resource lands are lost because of the burning, erosion, deforestation, and others (Keenan et al. 2015), this is in general, but the current situation in Syria is much worst for the vegetation cover due to the war, fires

caused by battles, and the displacement. According to UNHCR (2015) there are more than 11.5 million of the Syrian people displacement from their homes, And the consequent impact on agricultural activity and vegetation cover. There are no accurate statistics emerged yet because of the ongoing war in the country, on the other hand, traditional knowledge related to plant use will be lost in the absence of continuous cultural interaction (Cetinkaya 2009), and according to Huai & Xu (2000) most of the traditional medical knowledge is being lost before it is documented, studied or even noticed by science, From this point of view, concern is compounded of losing this traditional knowledge as millions of Syrians are displaced and culturally separated from their environment. Moreover, as we mentioned before, there is a very limited information on the use of local medicinal plants in Syria available in international literature sources, while there are no any related publications about the Syrian coastal. From all the above, it became clear the importance of choosing this region to study this topic.

2. Objectives of the thesis

The general objective of this thesis is to promote the preservation of the diversity and traditional knowledge of medicinal plants used in the study area. Syria is being under threat due to the destruction of their natural habitats, overharvesting of wild species and environmental changes. The study attempts to contribute to a greater understanding of the diversity and use patterns of medicinal flora in the region and to determine consensus on ethnomedicinal knowledge among informants and cultural importance of investigated species. Specifically, this thesis aims to document the diversity and ethnobotanical knowledge of medicinal plants used in the form of herbal teas in the coastal region of Syria through field ethnobotanical survey.

This study aimed to: (***i***) identify the medicinal plant species in the study area used for making herbal teas, (***ii***) document local ethnobotanical knowledge on plant species investigated, (***iii***) assess the homogeneity of ethnobotanical knowledge of the informants and to determine culturally important species, analyse the acquisition and use patterns of medicinal plant species in the context of herbal tea preparations.

3. Methods

3.1. Study area

The study was performed in the coastal region of Syria, including the provinces of Latakia in the north and Tartus in the south. This area is situated along the Mediterranean Sea coast with a length of 193 km and borders with Lebanon in the south, with Turkey in the north and from the east it is bounded by Syrian provinces of Idlib, Hama, and Homs (Kasparek 1995). The climate in the study area is a Mediterranean climate generally characterized by hot and humid summer beside the sea to moderate with less humidity in high mountains, (June-September) and a mild and wet winters (November-April) (Abou Zakhem & Hafez 2007). While the average rainfall varies from 920 mm in the coastal plains to 1200 mm in the coastal mountains (Ehrman & Cocks 1990). The area includes different plant ecosystems starting with coastal plains along the coastline and progressively changing vegetation towards the mountains (Dougherty 2004). The plains have extremely fertile soils thus they are areas with intensive agriculture systems, including greenhouses for production of vegetables, and *Citrus* spp. orchards. Towards the mountains olive trees start to cover most of the cultivated lands, At the higher altitudes (more than 900 m.a.s.l) apple is the dominant tree which needs much cold hours annually to be able for flowering, tobacco as well produced wildly in the mountains, according to WHO (1999) total annual deforestation attributable to tobacco in Syria is 18 %, which refers to the huge production especially in mountains where is exist forests.

The natural flora in the coastal region differs according to altitude into several layers, according to Baddour (2017), with an altitudinal range from the sea level to 300 m.a.s.l is covered by the wild olive *Olea oleaster* and *Ceratonia siliqua*, from 300 to 700 m.a.s.l above sea level the dominate trees are *Pinus* spp. and *Quercus* spp., while with an altitudinal range from 700 to 1100 it mainly exists *Quercus castaneifolia*, above 1100 m.a.s.l the main species are *Cedrus, Abies cilicica, Pinus halepensis* and *Pinus brutia*. The biggest nature reserve in the region is Al-Frnlouk with 5,390 ha where 240 plant species were inventoried, including four species listed in CITES. Unfortunately, 20% of this nature reserve has been burnt a few years ago because of the war battles happened in near areas (CBD 2016). What is attracting the attention of the visitor to these mountains is the view of the most mountain peaks as patches of forests, which is due to the presence of religious shrines. The people preserve trees around these temples because they believe

that trees bear the holiness of the place. The main rivers in the area are Al-Kabir Ashamali river, It discharges into the Mediterranean Sea, south of Latakia, and Al-Abrash River discharges into the Sea south of Tartus (Abou Zakhem & Hafez 2007). Demographically, population density is concentrated in cities centers close to the coastline. According to our observation, people who living in cities depend usually on the government jobs, those living in the mountains rely mainly on agriculture and on the army jobs, we have not observed any major industrial or commercial activity throughout the study area.

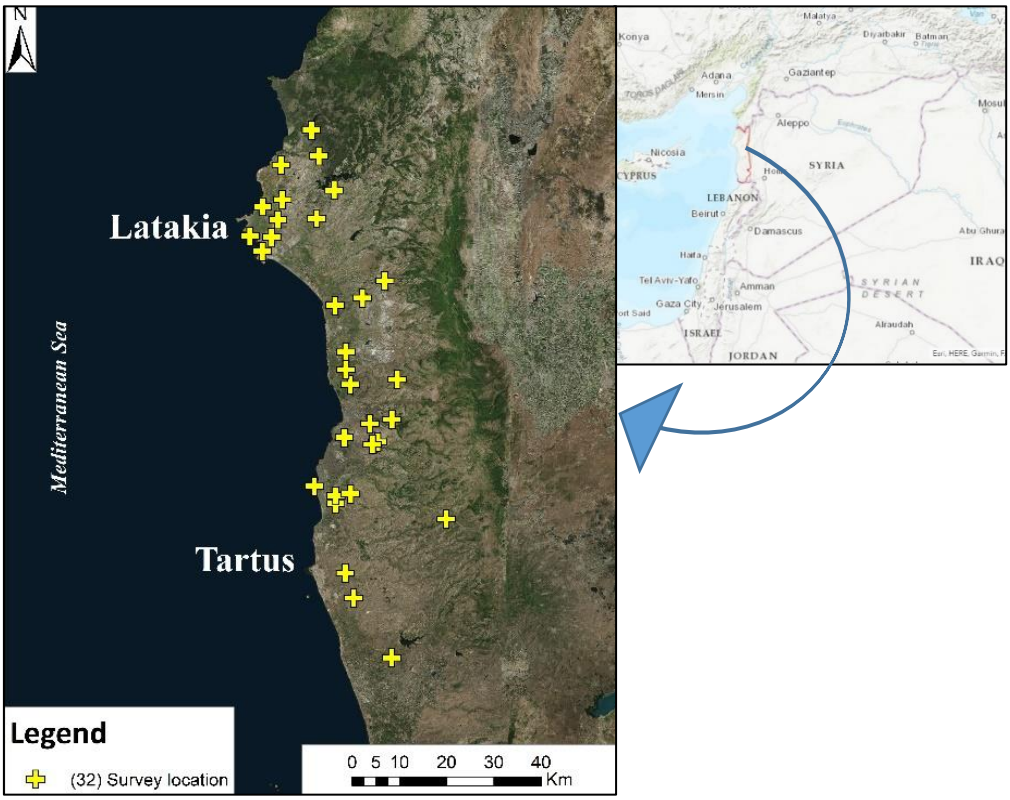

Figure 1: The study area, yellow points refer to villages of informants.
Source: The map was adapted from ArcGIS software.

3.2. Data collection

This This field study was carried out along the period of December 2017 until February 2018. The investigation took place in 32 geographical points along the study area (Figure 1). We targeted the informants who represent the whole spectrum of different cultural groups in the area. most knowledgeable community representatives who were capable of providing specific information concerning the traditional medicinal use of local plant resources. there are questionnaires taken from the plains more than the

mountains because of the density of people in plains. We take in a consideration as well the safety issues because there are war battles the northeastern of the area, the area called Kurd's mountain and considered as one of the richest diversity areas according to CBD (2016), its surrounding areas are still being hit by rockets grenades from time to time.

The data were collected by trained enumerators who have the previous knowledge in collecting data and who know the region very well, 5 colleagues from the Faculty of Agriculture in Tishreen University have been trained how to deal with ethnobotanical questionnaires.

Before starting in interviews, we did a rapid market observation to see the medicinal plants sold as teas in the local market. On the other hand we randomly selected some informants as a first stage, after interviewing them we asked for their recommendations about the most knowledgeable people in folk medicine, pursuant to a tips of Cotton (1996), that we have preserved the knowledge of wise and experienced people before it vanishes, in the end, we interviewed 11 of those knowledgeable informants, moreover, we tried to distribute informants between both sexes and different ages. On interviews, we followed the semi-structured interviews according to Martin (2004), all the interviews were individual to make direct contact with informants and to understand well from them. All questionnaires filled by the Arabic language., Firstly we informed the informants about the purpose of the research. Initially, respondents were asked to provide basic information (name, age, living place, education, and ethnicity and religion), because of the sensitivity of information related to ethnicity and religion due to current war conflict in Syria, prior to interviews, the informants were informed that in case the interviewer will ask questions or ask to do something that they do not feel is appropriate or make them feel uncomfortable, they can refuse to answer the questions at any time during the course of the interview. Subsequently, ethnobotanical information including the vernacular names of medicinal plant species used, plant parts used, their specific medicinal use, including if particular species were used individually or in mixtures was documented. Finally, respondents were asked to show the plant species mentioned on-site for preparation of a herbarium reference collection, we asked for tea sample if the plant was not available on site at the time of the interview. 3 plant species samples were not available, so we searched for a photo of the mentioned plant by the internet and we confirmed which plant species that informant means. The specimens which have been

collected and photos have been taken were identified in the department of plant production in Tishreen University Lattakia. All species' botanical names were verified according to The Plant List (http://www.theplantlist.org)

3.2.1. Demography of informants

The total number of informants that were interviewed in our study was 42 divided among 24 women and 18 men, 2 of informants were interviewed in a city, while 6 informants in towns, the rest of informants were interviewed in villages where is usually concentrated the traditional knowledge. The age of informants ranges between 22 to 76 years, but the proportion of old informants in our study was more due to their better knowledge of the local folk medicine. 80 % of the informants finished high school and more than half of them they have bachelor's degree, while 7 informants studied basic school. Most of the informants work in the government jobs which is not enough usually to cover their living costs, therefore they rely on agriculture products as the second source of money, they produce their need of some products and they sell the surplus in local markets. The coastal region of Syria is characteristic by multi-religion population, most of them are religious minorities in Syria like Christians, Ismaili, and Alawites who make up two-thirds of the population in the area (Bengio & Ben-Dor 1999). Ethnically, the Arabs constitute the overwhelming majority of ethnic groups in the region. According to the informants who answered the personal information part of the questionnaire, all of them are Arab and they distributed into 4 religion groups: Alawites, Christians Orthodox, Christians Catholic, and Islam Sunni.

3.3. Data Processing

3.3.1. Use Report (UR)

Medical citations obtained from informants were converted into Use Reports (UR) defined as: informant mentions the use of a plant species for the treatment of an ailment category (Chellapandian et al. 2012). Some informants in our study reported for more than three plants and every plant used for treatment of several categories, in this case one informant could inform about many use reports, while we obtained from other informants

only one report. Calculation of use reports allowed to us to calculate the following indexes.

3.3.2. Categorization of the ailments

All reported ailments and disorders were classified into 13 ailment categories according to Cook (1995). We aimed in that to organize the informant reports into groups, and to give it a right representation in the overall data, for example if an informant reported about a plant that it is used for stomach ache, colic, and heartburn, all such uses are considered as one-use report for digestive system disorders (Amiguet et al., 2005). We used 12 ailment categories classified according Cook and we added the recreational uses as a category which was not established in the mentioned classification.

3.3.3. Frequency of Citation (FC)

With a view to determining the most cited species in our survey, we calculated the frequency of citation which was defined by Tardío and Pardo-de-Santayana (2008): sum number of informants that mention a plant species as useful.

3.3.4. Use Value (UV)

It is a quantitative index proposed by Phillips et al. (1993), used to convert the value of locally used species into comparable numbers, it was calculated according to the following formula:

$$\text{UV} = \frac{U}{N}$$

Where U is number of citations per species (sum reports for each category use of a given plant species) and N is the total number of informants in the study. According to the last formula when a plant species cited more, its UV will be higher, and vice versa.

3.3.5. Informant Agreement Ratio (IAR)

This ratio refers to the agreement between informants on the use of each species (Trotter and Logan, 1986). It is calculating by the following formula:

$$\text{IAR} = \frac{Nr - Na}{Nr}$$

Where Nr means the total number of Use Reports registered for species and Na is the number of ailment categories that are treated by this species. The IAR value varies between zero and one, the higher values refer to higher ratio of agreement between informants on a use category of a given species.

3.3.6. Culture Value Index

This index, developed by Reyes-García et al. (2006), it refers to the most valuable species in the local culture and we used to achieve this goal, it is calculated by using the following formula:

$$CV = \{ \frac{NUs}{NC} \} \times \{ \frac{FCs}{N} \} \times \{ \sum\sum \frac{UR}{N} \}$$

Because this index is a little complicated let us give example *foeniculum vulgare* from our data with explaining. NU_s mean the number of different use categories for a given plant species, in our example *foeniculum vulgare* is used for treatment of two categories, NC is the total number of categories in our study which is 13 categories. While FC_s is the number of informants whom have mentioned about the plant that it is useful and in our example is 5, N refers to the total number of informants. In the last part of the formula we will get the same result of the

$$UV = \sum \frac{UR}{N}$$

Which refers to sum of informants who cited each given use of the particular species divided on the total number of informants, and then we will sum all of it together, in our example *foeniculum vulgare* there are 3 informants reported that it used for respiratory system disorders and 2 informants said that it used for digestive system disorders. Finally, the formula will be applied with those numbers like the following:

$$CV = \{ \frac{2}{13} \} \times \{ \frac{5}{42} \} \times \{ \frac{3}{42} + \frac{2}{42} \} = 0.00218$$

The higher values of this index refer to higher importance of species in the local culture.

4. Results

4.1. Medicinal plant species used in herbal teas

The study has documented 49 medicinal plant species, distributed among 48 genera and 20 botanical families. The most represented families were Lamiaceae (10), then Apiaceae (6), followed by Malvaceae and Fabaceae (4), Rosacea (3). The overall results of this study are shown in (Table 2), where plants are accompanied with their Latin name, botanical family, vernacular names, growth habit, part used, use categories, source of plant, another use, in addition to the following quantitative analytical indices: Frequency of Citation (FC), Use Value (UV), Informant Agreement Ratio (IAR), and Cultural Value Index (CV). All medical citations were converted into Use Reports UR, in total we got 303 UR which enabled us to calculate the mentioned indexes. The most cited plant species were *Ilex paraguariensis* (UR=42) use reports, *Micromeria myrtifolia* (UR=28), and *Mentha* spp. with (UR=24) use reports. As we see in the (Fig 2) the dominant growth habit in the cited species is the herb.

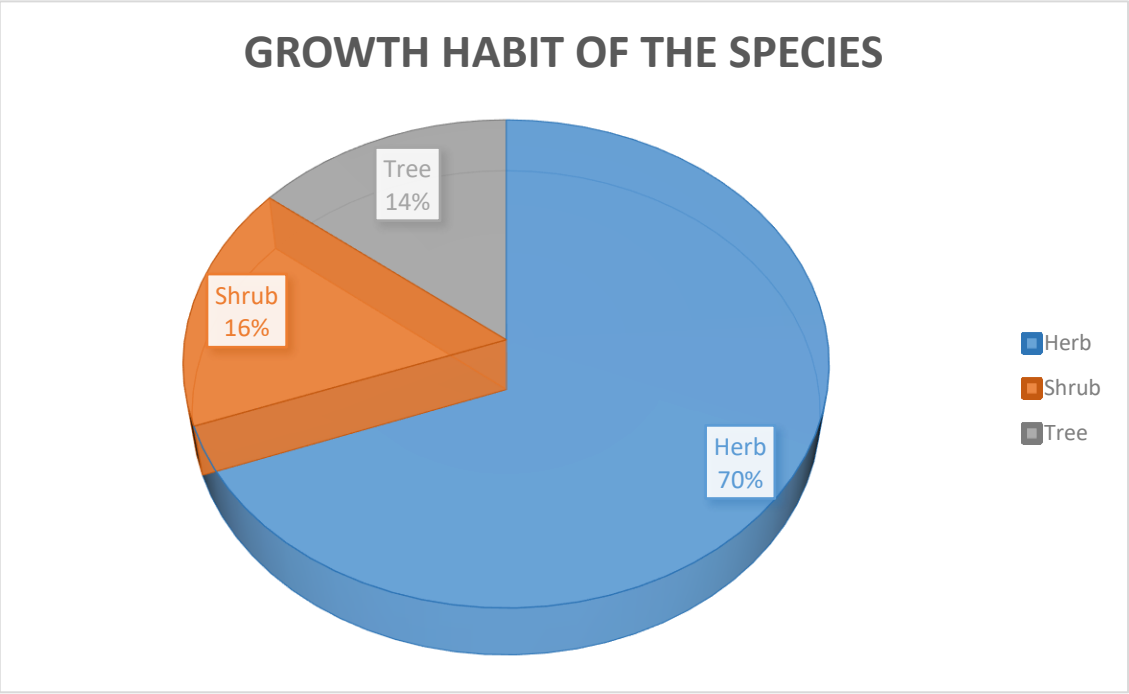

Figure 2: The proportion of growth habit in the cited species

4.2. Ailment Categories

We documented in our study 303 use reports divided into 13 use categories, including the category of recreational teas. As shown in the (Table 1) the most cited use category was recreational use with Mate (*Ilex paraguariensis*) which is considered the most preferred herbal tea in the study area. While the most cited diseases category was the digestive system disorders including stomachache, colic, dyspepsia, heartburn and others, the most preferred species for treatment of these disorders were *Mentha, Cuminum cyminum,* and *Lippia citriodora*. The category of respiratory system disorders came as the third group in the purpose of using the medicinal herbal teas, this category includes many illnesses like cold and flu, cough, asthma, expectorant, and others, the most preferred species to deal with these disorders were: *Micromeria myrtifolia, Origanum syriacum,* and *Rosmarinus officinalis.*

Urtica dioica came as the best species for genitourinary disorders mainly in prostate infections, it is used also by some informants to elevate the hemoglobin. *Pimpinella anisum* is a species used for calming and helping to sleep which considered in the mental disorders category. Interestingly *Crataegus azarolus* was one of the highest agreement ratio between informants, 4 use reports from 5 mentioned that it used for the regulation of heartbeat which included in the circulatory system disorders.

Table 1: Ailment categories according to the highest number of Use Reports.

Ailment category	**Number of informants**	**Number of use reports**	**Number of species**	**The most cited plant species**
Recreational	40	92	21	*Ilex paraguariensis, Micromeria myrtifolia, Lippia citriodora*
Digestive System Disorders	34	80	28	*Mentha, Cuminum cyminum, Lippia citriodora.*

Respiratory System Disorders	29	56	18	*Micromeria myrtifolia, Origanum syriacum, Rosmarinus officinalis*
Genitourinary System Disorders	12	20	15	*Urtica dioica, Ilex paraguariensis*
Mental Disorders	12	12	8	*Pimpinella anisum, Matricaria chamomilla*
Nutritional Disorders	8	9	7	*Camellia sinensis*
Circulatory System Disorders	7	10	6	*Crataegus azarolus*
Pain	6	8	7	*Lippia citriodora*
Endocrine System Disorders	4	6	4	*Trigonella foenum-graecum*
Blood System Disorders	2	2	1	*Urtica dioica*
Immune System Disorders	2	2	2	*Salvia officinalis*
Muscular-Skeletal System Disorders	2	2	2	*Carum carvi*
Nervous System Disorders	2	2	2	*Pimpinella anisum*

4.3. Sources of plants, and plants habitat status

There are different sources of medicinal plant used for making herbal tea, as we can see in (Fig 3) half of informants buy the plants form the local market, because some of these plants are not cultivated in the study area like *I. paraguariensis*, which is imported from Argentina and Paraguay and packaged in Syria then it is sold in local markets mainly in the coastal region. *P. anisum* is bought from the local markets as well, it is widely planted in plains of Al-Gab basin to the east of the coastal mountains. The local people are collecting 24% of medicinal plants from wild like *M.myrtifolia* and *O. syriacum*, while they are planting many of plant species in home garden such as *R. officinalis* and *L. citriodora*.

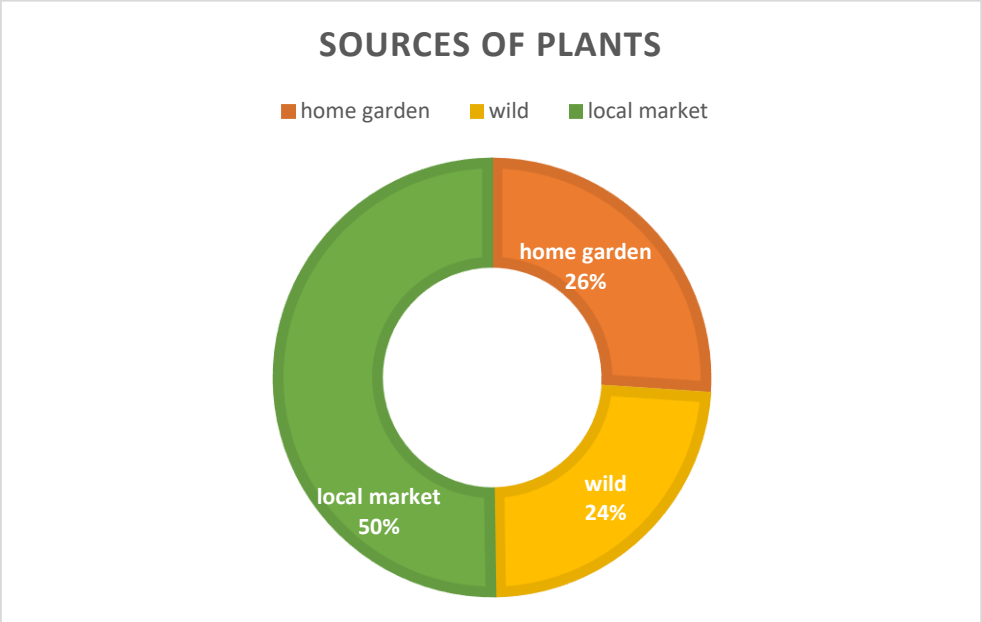

Figure 3: Sources of plant species

14 species in our study were cited that it is decreasing such as *C. azarolus*, *O.syriacum*, and *T. foenum-graecum*, which growing naturally in wild, there are several reasons of decreasing of these species, among them, the decline in land area, the fires resulted by the battles, the expansion of urbanization due to the high density of population in the region, especially after coming a large number of displaced people from the war areas, in addition to the over-collection of these species. It is worth paying attention that there are three species reported by some informants as threatened with extinction:

M.myrtifolia, Foeniculum vulgare, and *Teucrium polium*. They said it is decreasing rapidly and it became almost rare in the region.

4.4. Mode of preparation, administration, and plant parts used

There are several ways to process the medicinal plants after collection, it depends on the source of plant part used and its availability over the year, it depends as well on the best active form for treatment where some plants are more useful in the fresh form. In general, most of the herbal teas could be prepared from both fresh and dry plants. The species which planted in home gardens are mostly perineal herbs or shrubs such as *R. officinalis, L. citriodora, Mentha* spp. and *S. officinalis*, these plants used as fresh to prepare a tea. While the species collected from wild usually used as fresh when it exists in nature and dried when it is not available, for example, *M. myrtifolia* is used fresh for making the tea in the winter and spring months when it is growing naturally in the wild, and it is gathered in packages and dried in shade then it is stored for the other months of year. All drying types that we have documented are drying in shade, thus allowing to maintain their colour and shape, some of the dried plants are grinded and then stored in jars or bags.

Because of our study is about herbal teas, all the medicinal plants that were documented are prepared as infusions and applicated as a beverage, most of the plants are usually prepared in a local teapot with an approximate volume of 0.5 liters, after boiling the water, plants were infused for 5-10 minutes. the only exception in preparation is with *I. paraguariensis*, where is put dry grinded plant in a half of small cup with a pipette then added sugar and hot water, this process is repeated many times.

There are some plant species besides being consumed as a tea, it is also applied as inhalation, especially when infections of respiratory system, such *M. myrtifolia*, *Thymus vulgaris* and *Eucalyptus globulus*.

As we can see in (Fig 4), there is a diversity of plant parts used for making herbal teas, some species could be used different parts of it together such as *Poppy anemone* which used its flowers and leaves together to treat an acute cough. leaves part is the most reported with 22 species which means almost half of the species used for its leaves to prepare the teas. Surprisingly, flowers are used only in 8 species, although herbal tea is known in Syria as “Zhourat” which literally means in English “the flowers of plants that

is used for making herbal teas". The whole aerial part of 6 reported species are used for this kind of tea, such *as M. myrtifolia* and *T. polium*. while the seeds used mainly from species of the family Apiaceae. As shown in the (Fig 4) as well, bark, rhizome, and roots are used only from one species for each one.

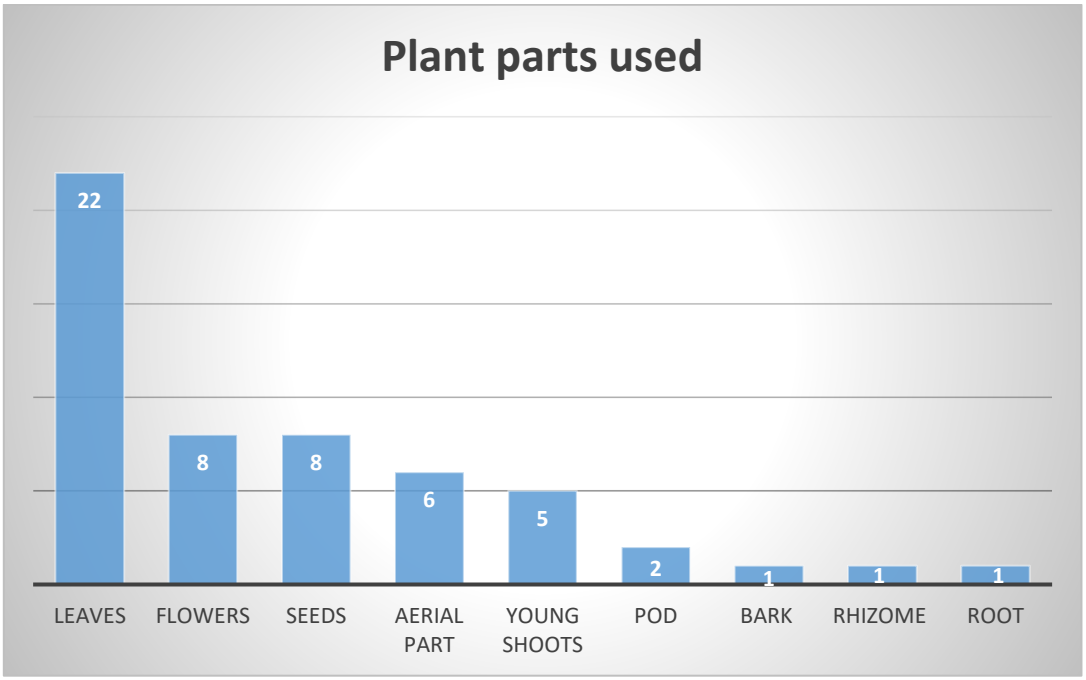

Figure 4: Number of species according to the plant parts used

Table 2: Ethnobotanical survey of medicinal plants used for making herbal teas in coastal Syria

Scientific name	Family name	English name	Local name	Growth habit	Part used	Use categories*	other uses	FCs *	UVs *	IARs *	CVs *
Althaea officinalis	Malvaceae	Althaea	Khetmiah	Herb	Flowers	Dig, Res, Gen, Rec.	–	3	0.12	0.25	0.00262
Ammi majus	Apiaceae	Khella	Alkhellah	Herb	Seeds	Gen, Rec.	–	1	0.05	0	0.00017
Anemone coronaria	Ranunculaceae	Poppy anemone	Shakaek Elnoaman	Herb	Flowers & leaves	Res.	–	1	0.02	0	0.00004
Camellia sinensis	Theaceae	Green tea	Chai Akhdar	Herb	Leaves & young shoots	Rec, Nut, Dig, Pai.	–	5	0.24	0.66	0.00872
Carum carvi	Apiaceae	Caraway	Kerrawiah	Herb	Seeds	Mus	–	1	0.02	0	0.00004
Ceratonia siliqua	Fabaceae	Carob	Kharnoub	Tree	Dried pods	Res, Rec.	Food	1	0.05	0	0.00017
Cichorium intybus	Malvaceae	Endive	Hendbah	Herb	Leaves	Rec.	Food	1	0.02	0	0.00004
Cinnamomum verum	Lauraceae	Cinnamon	Kerfah	Tree	Bark	Dig, Rec.	–	2	0.07	0.5	0.00052
Coriandrum sativum	Apiaceae	Coriander	Kezbarah	Herb	Leaves	Dig	Spices	1	0.02	0	0.00004

Scientific name	Family name	English name	Local name	Growth habit	Part used	Use categories	other uses	FC_s	UV_s	IAR_s	CV_s
Crataegus azarolus	Rosaceae	Hawthorn	Za'rour	Shrub	Flowers & young leaves	Cir, Gen.	Food	4	0.12	0.75	0.00174
Cuminum cyminum	Apiaceae	Cumin	Kammoun	Herb	Seeds	Dig, Rec, Nut, Pai.	Spices	7	0.26	0.7	0.01343
Cymbopogon citratus	Poaceae	Lemongrass	Mallesah Kesbiah	Herb	Leaves	Dig.	–	1	0.02	0	0.00004
Elettaria cardamomum	Zingiberaceae	Cardamom	Hel	Herb	Seeds	Dig.	–	1	0.02	0	0.00004
Eriobotrya japonica	Rosaceae	Loquat	Ekkdnia	Shrub	Flowers	Res, Gin.	Food	4	0.1	0.66	0.0014
Eucalyptus globulus	Myrtaceae	Blue gum	Keena	Tree	Leaves	Res.	–	1	0.02	0	0.00004
Foeniculum vulgare	Apiaceae	Fennel	Shamra	Herb	Seeds	Res, Dig.	Food flavour	5	0.12	0.75	0.00218
Glycyrrhiza glabra	Fabaceae	Liquorice	Araksous	Shrub	Roots	Dig, Nut	–	1	0.05	0	0.00017

Scientific name	Family name	English name	Local name	Growth habit	Part used	Use categories	other uses	FC_s	UV_s	IAR_s	CV_s
Gnaphalium purpureum	Asteraceae	Cudweed	Praiseeah	Herb	Leaves	Gen.	–	1	0.02	0	0.00004
Hibiscus sabdariffa	Malvaceae	Roselle	Karkadiah	Shrub	Flowers	Cir, Dig.	–	2	0.07	0.5	0.00052
Hordeum vulgare	Poaceae	Barley	Sha'eer	Herb	Seeds	Gen	–	1	0.02	0	0.00004
Micromeria myrtifolia	Lamiaceae	Zoufa	Zoufa	Herb	Aerial part	Res, Rec, Dig, Imm, Men.	–	16	0.66	0.85	0.09768
Ilex paraguariensis	Aquifoliaceae	Mate	Matteh	Shrub	Leaves	Rec, Gen, Dig, Ner, Nut, Men.	–	33	1	0.85	0.423
Laurus nobilis	Lauraceae	Bay leaf	Ghar	Tree	Leaves	Dig.	Oil for making soap	1	0.02	0	0.00004
Lavandula officinalis	Lamiaceae	Lavender	Lawand	Herb	Leaves	Dig.	–	1	0.0033	0	0.00004
Linum usitatissimum	Linaceae	Flax	Kettan	Herb	Seeds	Gen.	–	1	0.02	0	0.00004
Lippia citriodora	Verbenaceae	Lemon verbena	Mallesah	Shrub	Leaves	Dig, Rec, Pai, Gen, Men.	–	10	0.43	0.76	0.03924

Scientific name	Family name	English name	Local name	Growth habit	Part used	Use categories	other uses	FC_s	UV_s	IAR_s	CV_s
Malva sylvestris	Malvaceae	Mallow	Khpaizah	Herb	Leaves	Res.	Food	1	0.02	0	0.00004
Matricaria chamomilla	Asteraceae	Chamomile	Babounej	Herb	Flowers	Dig, Res, Rec, Men.	_	13	0.52	0.86	0.04989
Mentha Spp.	Lamiaceae	Mint	Na'na'	Herb	Aerial part	Dig, Rec, Res, Men, Mus, Pai.	Food flavour	13	0.57	0.78	0.08163
Myrtus communis	Myrtaceae	Myrtus	Rayhan	Shrub	Leaves	Dig, Pai.	_	2	0.05	0	0.00035
Ocimum basilicum	Lamiaceae	Basil	Habaq	Herb	Leaves	Rec.	_	1	0.02	0	0.00004
Olea europaea	Oleaceae	Olive	Zaitoun	Tree	Leaves	End, Cir.	Food	2	0.07	0.5	0.00052
Origanum majorana	Lamiaceae	Marjoram	Martakouch	Herb	Leaves	Rec, Gen, Men.	_	3	0.1	0.33	0.00157
Origanum syriacum	Lamiaceae	Biblical-hyssop	Zaouba'	Herb	Leaves	Res, Dig, Cir, Rec, Nut, Men.	Food	8	0.33	0.62	0.0293
Petroselinum crispum	Apiaceae	Parsley	Bakdounes	Herb	Leaves	Dig, Res, Gen.	Food	3	0.07	0	0.00118
Pimpinella Anisum	Apiaceae	Anise	Yansoun	Herb	Seeds	Dig, Men, Ner, End, Res.	Flavour for alcohol drink	8	0.31	0.58	0.02721

Scientific name	Family name	English name	Local name	Growth habit	Part used	Use categories	other uses	FC_s	UV_s	IAR_s	CV_s
Raphanus raphanistrum subsp. sativus	Brassicaceae	Radish	Fejel	Herb	Leaves	Gen.	Food	1	0.02	0	0.00004
Rosa Damascena	Rosaceae	Damask Rose	Ward	Shrub	Flowers	Dig.	–	1	0.02	0	0.00004
Rosmarinus officinalis	Lamiaceae	Rosemary	Ekleel AlJabal	Herb	Leaves & young shoots	Res, Dig, Cir, Pai, Men, Nut.	Food flavour	14	0.52	0.71	0.09402
Salvia officinalis	Lamiaceae	Sage	Maryamiah	Herb	Leaves & young shoots	Dig, Rec, Res, Gen, End, Imm.	–	7	0.29	0.55	0.02198
Senna alexandrina	Fabaceae	Egyptian senna	Senamkey	Tree	Leaves	Dig.	–	1	0.02	0	0.00004
Spergularia rubra	Caryophyllaceae	Red sandspurry	Na'emah	Herb	Aerial part	Gen.	–	1	0.02	0	0.00004
Teucrium polium	Lamiaceae	Felty germander	Kentariah	Herb	Aerial part	Dig.	–	2	0.05	1	0.00017
Thymus vulgaris	Lamiaceae	Thyme	Za'tar Barri	Herb	Leaves & flowers	Res, Dig, Rec.	Food flavour	6	0.17	0.67	0.00549

Scientific name	Family name	English name	Local name	Growth habit	Part used	Use categories	other uses	FC_s	UV_s	IAR_s	CV_s
Tilia cordata	Malvaceae	Little-leaf Linden	Zaizafoun	Tree	Flowers	Res.	–	1	0.02	0	0.00004
Trigonella foenum-graecum	Fabaceae	Fenugreek	Hellibah	Herb	Pods & leaves	End, Rec.	–	3	0.07	0.5	0.00078
Urtica dioica	Urticaceae	Nettle	Kerrass	Herb	Young leaves	Gen, Blo, Rec.	–	5	0.17	0.67	0.00458
viola papilionacea	Violaceae	Wild Viola	Banfsaj	Herb	Flowers	Cir.	–	1	0.02	0	0.00004
Zingiber officinale	Zingiberaceae	Ginger	Zangabeel	Herb	Rhizome	Dig, Res, Nut.	Spices	3	0.07	0	0.00118

***: FC_s**: Frequency of Citation, **UV_s**: Use Value, **IAR_s**: Informant Agreement Ratio, **CV_s**: Cultural Value Index, **Rec**: Recreational use, **Dig:** Digestive system disorders, **Res**: Respiratory system disorders, **Gen**: Genitourinary system disorders, **Men**: Mental disorders, **Nut**: Nutritional disorders, **Cir**: Circulatory system disorders, **Pai**: Pain, **End**: Endocrine system disorders, **Blo**: Blood system disorders, **Imm**: Immune system disorders, **Mus**: Muscular-Skeletal system disorders, **Ner**: Nervous system disorders.

4.5. The most culturally important species

We determined in our study the most locally important medicinal plant species that are used for making herbal teas. As we can see in (Table 2) There are 49 plant species, according to the Cultural Value Index we could know the most valuable species in the local culture. we selected the highest 7 values from the mentioned index as shown in (Table 3), those species have also the highest values in the Use Value Index which it confirms their importance. The most important species was Mate (*I. paraguariensis*) which has Use Value 1, this means that the number of use reports equals the number of informants, 33 informants have reported about this plant which means 79% of the total number of informants in our study. There is a diversity of uses for each of those important plants, the majority of uses is concentrated in treating the respiratory infections and digestive disorders.

Table 3: List of the most important medicinal plant species used for making tea by the local people in coastal Syria

Scientific name	Family	English name	Local name	Growth habit	Part used	Uses	Use reports	UVs	IARs	CVs
Ilex paraguariensis	Aquifoliaceae	Mate	Matteh	Shrub	Leaves	Recreational tea, diuretic, kidney stones, headache, accelerate digestion, improve concentration, stimulant, weight loss.	42	1	0.85	0.423
Micromeria myrtifolia	Lamiaceae	Zoufa	Zoufa	Herb	Aerial part	Recreational tea, cough, cold and flu, expectorant, stomach ache, asthma, calming, hoarseness, tonsillitis.	28	0.66	0.85	0.09768
rosmarinus officinalis	Lamiaceae	Rosemary	Ekleel AlJabal	Herb	Leaves & Young shoots	Recreational tea, cold and flu, cough, colic, headache, memory enhancing, calming, intestine pain, slimming.	22	0.52	0.71	0.09402
Mentha	Lamiaceae	Mint	Na'na'	Herb	Aerial part	Recreational tea, colic, stomach ache, throat pain, calming, nausea, muscle spasm, headache	24	0.57	0.78	0.08163
Matricaria chamomilla	Asteraceae	Chamomile	Babounej	Herb	Flowers	Recreational tea, colic, stomach ache, cold and flu, pharyngitis, gums pain, calming, diarrhoea.	22	0.52	0.86	0.04989
Lippia citriodora	Verbenaceae	Lemon verbena	Mallesah	Shrub	Leaves	Recreational tea, colic, headache, kidney stones, calming	18	0.43	0.76	0.03924
Origanum syriacum	Lamiaceae	Biblical-hyssop	Zaouba'	Herb	Leaves	Recreational tea, pharyngitis, cough and expectorant, Stomach ache, regulation of blood pressure, calming, slimming	14	0.33	0.62	0.0293

4.6. The herbal mixtures used for making tea

One part of our questionnaire was about the mixtures of medicinal plant species used for making tea, in the end, we documented 26 of these mixtures, 8 species are used as an essential ingredient for mixtures, and 26 species are added with to those main species. The medicinal use of mixtures is changing between species even when it used with same species. For example, *I. paraguariensis* is used with 11 different species for 11 different purpose of use, it is used with flowers of *E. japonica* for treatment of a cough, while it is used with the leaves of *O. europaea* to regulate of blood sugar. 4 informants reported that *R. officinalis* when it is mixed with *I. paraguariensis* are used together for treatment of a cough. As we can see in (Table 4) the mixture of *L. citriodora and O. majorana* is used to decrease the pain of premenstrual syndrome.

There are 5 species used as main ingredients in mixtures were mentioned as well in (Table 3) as important species, which again confirm the importance of those species. Some species are used for the same use, and when it mixed together are obtaining better effective against the illness, for example, the mixture of *M. myrtifolia* and *O. syriacum* for treatment of a cough. Regarding plant parts used of species listed in (Table 4), it is the same what was already mentioned in (Table 2).

Table 4: Mixtures of medicinal plants used of making herbal tea

Scientific name (key ingredient)	Scientific name	Medicinal use of the mixture	Use Reports
Micromeria myrtifolia	*Matricaria chamomilla*	Cold and flu, colic	1
	Thymus vulgaris	Stomach ache, flu, cough	2
	Origanum syriacum	Pharyngitis, cough, slimming	3
Mentha	*Urtica dioica*	Prostate infections, kidney stones	1
	Lavandula officinalis	Stomach ache	1
	Matricaria chamomilla	Colic	1
Camellia sinensis	*Eriobotrya japonica*	Cough	1
	Cinnamomum verum	Colic, diarrhoea	2
Rosmarinus officinalis	*Urtica dioica*	Muscle spasm, colic	1
	Viola papilionacea	Regulation of blood pressure	1
Salvia officinalis	*Origanum syriacum*	Cough, expectorant	2
Urtica dioica	*Ammi visnaga*	Kidney stones, diuretic	2

Ilex paraguariensis	*Eriobotrya japonica*	Cough	1
	Thymus vulgaris	Cough, expectorant	1
	Micromeria myrtifolia	Cold and flu, cough	2
	Olea europaea	Regulation of blood sugar	1
	Teucrium polium	Stomach ache	1
	Gnaphalium purpureum	Diuretic	1
	Crataegus azarolus	Regulate heart pressure, diuretic	3
	Rosmarinus officinalis	Cough	4
	Foeniculum vulgare	Colic	1
	Matricaria chamomilla	Colon cramps, colic	2
	Althaea officinalis	Cold, colic	3
Lippia citriodora	*Petroselinum crispum*	Kidney stones	2
	Rosmarinus officinalis	Headache	1
	Origanum majorana	Premenstrual syndrome pain	1

5. Discussion

5.1. Diversity of medicinal plants in the study area and neighboring areas

The results of our study showed that the majority of medicinal plants used for making herbal teas in coastal Syria are similar to that used in other areas in Syria and neighboring countries, with a few differences that characterize the study area from others. Starting with families, Lamiaceae and Apiaceae were the most represented families in our study area as well as in herbal teas consumed in Damascus and Lebanon (Obón et al. 2014), and according to Güzel et al. (2015) Lamiaceae is in the first and Apiaceae is in the third of represented families in medicinal plants used in Antakya, the Turkish province that bordering northern part of our study area and which considered as a natural and a cultural extending of the coastal region in Syria. The dominant families of medicinal plants in Hermon mountain on the border between Syria and Lebanon were Compositae, Labiatae, the height of the mountain is 2,814 m.a.s.l and that explains the differences in flora with other areas.

We documented 49 plant species in the region, 29 species of them are exist in the list of most 100-common species used in the folk medicine in Aleppo north of Syria (Alachkar et al. 2011), but there were differences in the used parts and in the mode of application, for example the flowers of *Eriobotrya japonica* used in our study as a tea, while according to Alachkar et al. that its leaves are used for making tea. *Rosa damascena* has been mentioned by both Obón et al. (2014) and Carmona et al. (2005) as the main ingredient of making mixtures of herbal tea consumed in Damascus, while it was cited only once in our study, according to our interpretation it is due to that this species originated in Damascus and it is widely cultivated in rural Damascus with 200 hectares (Syrian exporters federation 2017). The similarity of flora on the coastal line of East Mediterranean leads to similarity in species used in traditional medicine, the following species in our study *Ceratonia siliqua, Trigonella foenum-graecum, Ammi* spp., and *Myrtus communis* are used in traditional Arab herbal medicine in Palestine according to a review was done by Azaizeh et al. (2006) in Haifa University.

In Mosa mountain which located between 350 m and 1,700 m.a.s.l in Lebanon a survey has been done by Baydoun et al. (2017) shown that the main medicinal plants in the area are: *Malva* spp., *Matricaria chamomilla, Melissa* spp., *Mentha* spp., *Micromeria* spp., *Origanum* spp. and *Saliva* spp., most of these species are used widely in coastal Syria as herbal teas as shown in our results. In Cyprus, which is located on less than 100 kilometres to the west of the Syrian coastline, we found through a survey on the herbal market in Cyprus that there are many similar species with ones in our study area, for examples: *Coriandrum sativum, Cuminum cyminum, Matricaria Chamomilla,* and *Mentha* spp.

The scoop of our results was that we documented 4 plant species that are not used in other areas in Syria and 3 of them are not mentioned before in the east of Mediterranean according to the published articles up to date. The first species is *Ilex paraguariensis*, we found that it consumed in South America and Europe and Middle East, but without any spatial or ethnobotanical identification of its use in middle east, according to the best of our knowledge that Mate is beside its used in coastal Syria, also used by Druze community in the south of Syria, Golan Heights and Lebanon, but we could not find scientific publication to confirm that. The second species *Organgum majorana* Which has not mentioned in the published ethnobotanical articles in Syria up to date. *Spergularia rubra* and *Gnaphalium purpureum* are not existed in any ethnomedicinal study along the middle east up to date.

5.2. The traditional uses of herbal teas

Analysis of our data showed, that it is difficult to separate the recreational and the medical use of the herbal tea, because that most of plant species are used for both of purposes at the same time, while there are some species are used specifically and exclusively for illnesses treatment. According to Obón et al. (2014) "Zhourat" is a healthy mixture herbal tea served in tea houses, restaurants, cafes or at home as a social activity in many regions in Lebanon, in southern Lebanon it is usually consumed as a relaxing tea at night before bed. In our study 40 from 42 informants reported about the recreational use of the herbal tea, some informants use herbal tea 14 times per week, 2 informants said

they consume Mate for 21 times per week with a kind of addiction, which probably could be due to its consist of Caffeine.

The main ailment categories treated by herbal teas were digestive system disorders and respiratory system disorders, with almost half of use reports in our results. The most cited illnesses in digestive was stomach ache, it is treated mainly by *Mentha* spp. and *Lippia citriodora*, and less by other species, also *Mentha* spp. was recorded as a recommended tea for treatment of stomach ache by Obón et al (2014), Carmona et al. (2005), Baydoun et al. (2015), and Güzel et al. (2015).

Regarding the respiratory disorders, 18 species in our study were used for making medicinal tea against respiratory infections, while there are 13 key ingredients for making a tea that are used for the same purpose in Lebanon (Obón et al 2014).

The Genitourinary system disorders is one of the main element categories treated by herbal teas, *Urtica dioica* was cited in our study as important species for treatment of prostate infections and kidney stones, but it was not mentioned in both studies made about herbal teas in Damascus, this species is growing naturally in the coastal mountains, it has a stinging juice and cause an itchy skin, one study has been done by Konrad et al. (2000) found that this species has medicinal effect on the human prostate cancer cells.

Olea europaea is a species cited in our results, it has effect to regulate the blood sugar and blood pressure by preparing tea from its leaves, Alachkar et al. (2011) has confirmed that it used as well for the same purpose in Aleppo, Zam and Ali (2017) have done a study in Tartus about the olive leaves tea effect in type 2 of diabetic patients with prehypertension, and they found that it reduced the values of blood sugar after 4 weeks of application.

5.3. The most important species in the local culture

According to the quantitative data analysis, we were able to determine the most important species where the cultural value index showed us the most locally valuable species, as is shown in the (Table 3). The importance of these species is due to their extensive use by the local population in the study area, and to its wide range of using for both recreational and medical uses. Some of those species are growing naturally and it is

used widely in many areas along the middle east such *M. myrtifolia, R. officinalis,* and *Mentha* spp (Obón et al 2014; Carmona et al. 2005; Baydoun et al. 2015; Güzel et al. 2015; Raafat & Apostolides 2017; and Karousou & Deirmentzoglou 2011).

I. paraguariensis is the most important species in the local culture, the people offer this tea to the guests as kind of the maximum welcome, despite the local importance of this plant, it is not cultivated in the area, but it is imported from South America. Interestingly, the informants told us about the story of this tea, that their ancestors emigrated to South America in the 19th century as a result of the persecution of minorities under the Ottoman Empire, and when they began to back home they brought with them this tea and that it was the beginning of spread this tea in the local beverage culture. we have not found any published paper has studied this tea in the Middle East.

O. syriacum is another important species which used for pharyngitis, cough and stomach ache, we found that species is used also as ingredient in the mixtures of herbal teas in Damascus (Obón et al. 2014), as well as in Aleppo (Alachkar et al. 2011), in Lebanon (Baydoun et al. 2017), and in Antakya south of Turkey (Güzel at al. 2015). Alma et al. (2003) found that the oil extracted from *O. syriacum* has a strong antimicrobial activity against 13 of 16 microorganisms tested.

5.4. Mixtures of the herbal teas

Our results showed that the majority of use reports were about species used individually for making tea, from 303 (UR) we got only 42 (UR) about herbal mixtures, 31 species used in 26 herbal mixtures for making tea, each mixture consists from two species as shown in (Table 4).

The mixtures that we documented are not compatible with those sold in Damascus or in major cities in Syria and Lebanon, which already pre-prepared and sold in specialist shop of herbs (Carmona at al 2005, Obón et al 2014), that is due to the local people in the Syrian coast are preparing the mixtures by themselves, they mix two plant species (or probably more but what we have documented were mixtures of two species only), half of the used plant species are collected from the wild or from the home gardens as shown in

(Fig 3). They do not buy ready mixtures from shops, but only individual species that are not available in the wild or their home gardens.

According to our interpretation, the purpose of using the herbal mixtures is to increase the tea effectiveness against the disease, or to make the drink acceptable, when one of the species has unacceptable taste, mixed with another plant which has acceptable taste to make in the end a useful and a tasty tea.

According to Obón et al. (2014) the key botanical components of the herbal tea sold in Damascus and Lebanon should include *R. damascena, Althaea damascena, M. chamomilla, Aloysia citrodora palau, Zea mays* and *Elaeagnus angustifolia*. While the key species for making herbal mixtures in our study were: *I. paraguariensis, M. myrtifolia, Mentha, L. citriodora* and *R. officinalis*. According to our interpretation, the components of mixtures is changing according to the availability of plant species and the preferable taste in local beverage culture, as well as to the desired benefits of blending those species.

6. Conclusions

The study has documented traditional uses of 49 medicinal plant species used in the form of a tea, reported by 42 informants from 32 geographical points along the coastal region in Syria. The documentation included the name of plant species, genera, family, vernacular names, habit, part used, uses, another uses, source of plant, mode of preparation, and status of plants. The study documented 4 plant species that are not used in other areas in Syria and 3 of them are not mentioned before in the east of Mediterranean according to the published articles up to date. Lamiaceae was the dominant plant species family, herbaceous species were confirmed as a most common plant life form of medicinal plants used for making tea. The local market was the source for half of the plant species, while the second half was divided between wild habitats and home gardens. Leaves was the most cited plant part used in preparing tea. Recreational use was the most frequent category for tea use, while the digestive system disorders were the most common ailment category treated by the herbal tea. the most locally valuable species were determined by the highest values of Cultural Value Index, those species are*: I. paraguariensis, M. myrtifolia, R. officinalis, Mentha, M. chamomilla, L. citriodora,* and *O. syriacum.*

The diversity of reported species and the uses of some important species has been discussed and supported by ethnomedicinal and ethnopharmacological studies in Syria and neighbouring countries. The study has documented 26 herbal mixtures prepared by 31 plant species, and the mixtures obtained in our results were compared with two studies on herbal mixtures.

The results of this pilot study captured a threatened part of ethnomedicinal knowledge. It contributed to the biodiversity conservation, preservation of the biocultural heritage, and documentation for a part of the beverage culture in the study area.

Besides the highlighted important species which could have a potential economic value, we found the species *Gnaphalium purpureum* that have not been well-explored yet, therefore laboratory testing should be performed to evaluate biological activity and health benefits of these species, Side by side, further ethnobotanical studies have to be done in the future to cover the information gap in this field.

7. References

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Appendices

Appendix 1: Photos

Local herbal shop

Matricaria chamomilla

Micromeria myrtifolia

Origanum syriacum

Dried medicinal plants used in making herbal

Micromeria myrtifolia

Flowers of the species *Eriobotrya japonica*

Tea from the species *Ilex paraguariensis*