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Research Title: Ethnobotanical survey of medicinal plant *Teucrium* L. (Lamiaceae) in eastern Libya

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Abstract

This investigation deals with the survey of the ethnobotanical uses of the *Teucrium* species in eastern Libya, Mediterranean city. The survey done through questionnaire of 78 elderly peoples their ages over 35 years, male and females beside 70 herbal medicine shop to understand the uses of the different *Teucrium* species in the eastern region of Libya. The study carried from April 2018 till April 2020 in several cities and villages in the study area, which is Benghazi, Tobra, Al-abyar Al-Marj, Elbaida, and Ajdabya. Photographs and herbarium specimens were showed to the interviewers to recognize the species they used in their treatments. Elderly peoples were more informative than young ones, as well as those living in the villages who have more knowledge than those living in the cities. The Relative Frequency of Citation (RFC), Usage Value (UV) and Informants Agreement Ratio (IAR) have been calculated for the twelve wild species of the genus. *T. pollium* was the widest spread used between the peoples and used in the treatment of many diseases with the highest UV, RFC and IAR. Libyan peoples still rely on the herbal medicine and they can use herbs in curing their fatigue and illness.

Keywords: Ethnobotany - Folk Medicine – Libya - *Teucrium*

1. Introduction

Since the beginning of man on Earth, they used plants in medical treatments and curing from their illness and fatigue. This knowledge bequeathed from generation to generation encompassing concepts for protection and restoration of health. Gradually, and as the scientific considerations developed these plants undergone analyses and examinations to get more benefits from them. From the Aristotle up into the 18th century botanical and medicinal knowledge was documented and spread in illustrated herbals. Due to the rising costs and side effects of synthetic drugs for personal health, peoples returned back to explore new plant-derived drugs and became interest in the medicinal plans documentation and usage (Hoareau and DaSilva 1999) [9]. Poor developed and Asian countries became now pioneer in traditional use of herbs and restore their experience in this field. In fact they restore their inherited knowledge and began to get the more benefits from their wild natural plants. These herbs became in the form of tablets, mixture of herbs or even in liquid form and selling in these countries in herbal shops called Attar or indigenous practitioners for use. In fact the use of herbs is not always safe, but Posadzki *et al.* (2013) [15] reported several side effects from using some hers without precautions. Ekor (2011) [5] warned from the side effects caused from the use of inadequate knowledge of the mode of action of these herbs.

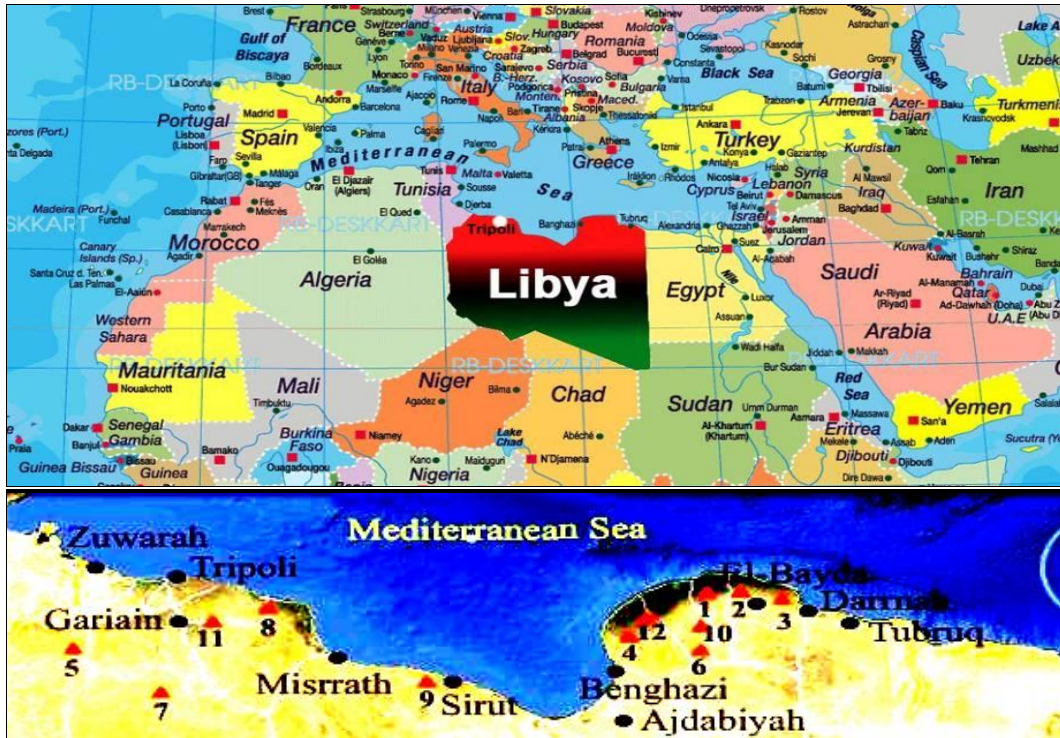
From the most important groups of plants in the treatment of many illnesses are those containing volatile oils in their

tissues, bioactive compounds or alkalis. Families Leguminosae, Euphorbiaceae, Apocynaceae, Malvaceae, Amaranthaceae, Rutaceae, Lamiaceae, Menispermaceae, Asteraceae, Phyllanthaceae, Rubiaceae, Zingiberaceae, Moraceae, Solanaceae, and Vitaceae considered from the most important families in this concept worldwide (Phumthum *et al.* 2019) [14]. Members of family Lamiaceae are widely used in traditional uses for their highly contents of volatile oils. This family, considered one of the most important herbal families, incorporates a wide variety of plants with biological and medical applications such as the aromatic spices thyme, mint, oregano, basil, sage, savory, rosemary, self-heal, hyssop, lemon balm, and some others with more limited use (Bekut *et al.* 2018) [3]. This family is the largest within order Lamiales and has about 236 genus (Harley *et al.* 2004) [8] classified under 22 tribe and 12 subfamily. Genus *Teucrium* is the largest genus in tribe Teucriae Dumort., subfamily Ajudoideae Koste (Zhoa *et al.* 2021) [19]. Members of this genus is traditionally used in Libya in the treatment of many diseases and illness such as tumor, diabetes, polycystic ovaries, female infertility, hypertension, antipyretic, anti-diarrheal, anthelmintic, oral sanitizer, headache, nausea, antibacterial, insect bites, and antirheumatic. On the basis of the information data gained from the peoples on the local medicinal uses of this genus, this investigation has been done. The aim of this work is to focus on the beneficial uses of the *Teucrium* species and know if there are any side effects recorded from its use by the peoples in the studied areas.

Study area

Libya occupies a part of northern Africa from 20 to 34° N and 10 to 25° E. It is bounded from the east by Egypt, from the west by Tunisia and Algeria the Mediterranean sea, in the north, and in the south by Sudan, Chad and Niger (Map 1) (El-Tantawi 2005) [6]. In Libya about 94 to 96% of the land is desert and it is one of the driest countries in the world (Holdridge 1974) [10]. Landforms of Libya generally

consist of barren plains in the north against plateaus and depressions in the south, the Mediterranean coast lands and the Sahara desert are the most prominent natural features. Though there are several highlands, no true mountain ranges exist except in southern desert near the Chad border where the Tibesti Massif rises to over 3,000 m asl. The genus is represented by twelve species distributed in the arid Libyan Desert as mentioned in Jafri and El-Gadi (1977) [11].



Methodology

The work depends on interviews with local peoples in the studied cities, as well as, with owners of shops selling medical herbs and spices (Attar). The local people, as well as the owner shops, cannot differentiate between the different species and they call all the species by the same name Jadah. For that they showed series of each species image to differentiate between the types of species they used. The different species were collected and photographed from the field trips carried by both A.A.Asker and S.A.Mohamed and identified by the aid of the local flora and experts in Omar EL-Mukhtar University herbarium, El-beyda, Libya and shown in plate 1. The data collected refer only to those described by informants who claimed to know the *Teucrium* species used in traditional medicine and its applications.

Materials and methods

Field survey was carried out over the period of two years i.e., April 2018 –April 2020 through interviews with 70 shops selling medicinal plants (Attar in Arabic) found in several cities and villages in eastern Libya, which is Benghazi, Tocra, Al-abyar Al-Marj, Elbaida, and Ajdabya. As well as questionnaires were done to seventy eight interviews; male and female; in these areas to understand the traditional use of the (Jadah) common name of the genus *Teucrium*. Most of the people were acquired only the bases of reading and writing (32 did not receive any education).

Specific questions focused on the different ethnobotanical uses traditionally practiced in their area. The data of the different species of *Teucrium* collected through field trips shown in table (1). The data obtained from interviewed 78 informants, divided into 38 women (35-75 years old) and 40 men (37-80 years old). The interview sought information about the local uses of *Teucrium* and the plant part used in preparation and which disease treatment citations. The interviews were conducted individually as possible, but sometimes relatives, onlookers and secondary participants were present. The average duration of the interviews was from half an hour to an hour. Ethnomedicinal data was evaluated using the following analyses.

Quantitative ethnobotanical data analysis

Relative frequency of citations (RFC)

This is the fraction of informants that recognized a given plant in local folk medicine. The relative frequency of citations (RFC) was used to evaluate the relative importance of plant species by the following formula (Shaheen *et al.* 2017) [17].

$$RFC = FC/N$$

Where, FC is the number of informants reporting the use of a particular species and N is the total number of informants.

The use value (UV) was calculated to measure the

importance of individual plant species by using the following formula (Rokaya *et al.* 2010)^[16].

$$UV = \text{Usage Value } (\sum U_i) / N$$

Where U_i is the number of peoples uses and N = total number of peoples in this investigation, the value will be ranged from 0 -1.

Informants Agreement Ratio (IAR) is used to quantify the importance of plants for which there is uses on more than one medicinal treatment. Thus, a plant with a high number of citations in more than one use category may rank higher than plants with more citations in any single category. IAR was calculated as follows (Vandebroek 2010)^[18].

$$IAR = (N_r - N_a) / (N_r - 1)$$

Where N_r is the total number of use citations for a given species across all therapeutic categories and N_a is the number of cited therapeutic categories

Results and Discussion

Pardo-de-Santayana and Macía (2015)^[13] indicated to the importance of understanding the ethnobotanical methods and innovations not only for recording the uses of the ancient peoples to the plants but also to improve human life conditions. Medicinal plants are widely distributed in most countries; especially the Arabic peninsula, Asia, Sinai and Mediterranean countries. Bedouins are expert in using herbal medicine in curing many diseases. They use them as drinks, or chewed fresh or dry raw materials. Also they use some herbs externally to cure dermal diseases, either viral or bacterial infections, insects or animal bites or burns. Gras *et al.* (2021)^[7] reported the most important families in ethnobotanical uses are Asteraceae (52), Fabaceae (30) and Lamiaceae (25). Genus *Teucrium* is rich in bioactive compounds (Asker 2015)^[2]. Peoples in Libya use some *Teucrium* species as spices in cooking, drinking the water extract as teas and added the leaves in other drinks. Asker (2015)^[2] found that the Libyan species of the genus *Teucrium* are very rich in secondary metabolites with high significant biological activities. In the local folk herbal medicine, *Teucrium* species are used in the treatment of many digestive and respiratory disorders, abscesses, gout, and conjunctivitis. Worldwide the different species of the genus used as anti-inflammatory, anti-oxidative, anti-cancer, anti-microbial, anti-diabetic, and anti-helminthic (Jaric *et al.* 2020)^[12]. The elderly interviewers were more acquainted in the recognition and usage of the plant species. This observation has been noticed by Doyle *et al.* (2017)^[4] who reported a significant correlation between the age and knowledge of the herbal medicine. In the interviews, photographs of the different species have been shown to each one to recognize the species used. In the same time herbarium specimens of the plants is shown to them to facilitate their identification and give precise use for each species. The data obtained from the interviewers coincide with that obtained from the Attar shops. The most popular species in Libya is *T. pollium*, as most of the interviewers recognized it and used in a variety of treatments. This species is also used as folk medicinal herb in many

countries as mentioned by Doyle *et al.* (2017)^[4] and Jaric *et al.* (2020)^[12]. This species, with its different morphological variations, has the greatest number of Usage Value (UV) and Informant Agreement ratio (IAR). The local use of this species is very wide, they use the hot drink of the aerial parts in the treatment of the gastrointestinal pains, cold, anti-inflammatory, anti-bacterial, cancer treatment, kidney stones, and pain of the menstrual cycle and as anti-oxidant. They also drink the boiled leaves in headache and stomach pain. This species has been recorded as important medicinal herb from more two hundred years in Libya (Abdollahi *et al.* 2003)^[1].

In this work seventy-eight interviews with adult informants; over 35 y.; conducted with 55 males and 21 females. As well as seventy shops selling spices and medicinal plants (Attar) were subjected in this work. Most of the peoples could not differentiate between the species and give all of them the name Jaddah (vernacular name of *Teucrium*). They differentiate the species by their leaves and flowers only. For that we have to show the peoples the photographs of the different species for accuracy as shown in photos. 1-12. In order to facilitate the interpretation of the data, the use citation of each species were grouped in six categories as listed in table 2. The plant parts used in the treatments are mostly the leaves and aerial shoots, that they cut it and boiled and drink it as tea drink. For skin treatments and injuries the leaf extracts were used as poultice and cover the skin, for respiratory ailments they use the hot leaf extracts for inhaling as water bath, or the boiled leaves as tea drink. In using *Teucrium* leaves in the treatment of diabetic peoples, they used to drink a cup of boiled leaves of *T. pollium* before eating three times daily. The most cited uses were the gastrointestinal complaints, then respiratory ailments and kidney stones. The most used species is *T. pollium*, the two forms and subspecies, in which the usage value is over 90%. Then *T. zanonii* (UV= 56%) and *T. apollinis* (UV= 54%). The IAR was greatest in *T. pollium* which used in the treatment in most of the illness groups between the interviewers and shop sellers, then *T. fruticans*. The local use of *Teucrium* species in weight control did not report within the interviewers.

The participants in this work were 78 informants, divided into 38 women (35-75 years old) and 40 men (37-80 years old), beside 70 Attar shop. The interview sought information about the local uses of the different taxa of *Teucrium* and the plant part used preparation and disease citations. There were no confusions in the knowledge of both men and women. Meanwhile the owners of the herbal medicine shops agree with the information taken from the participants. Elderly people, over 60 y, have more accurate uses of the plants than the young ones; they can chew the aerial parts in their treatments. For that we concentrate on the old Bedouins to know how they used each species in treating their illness (Tables 2 & 3).

The information taken from the peoples in Al-Abyar city were restricted to certain ailments like kidney stones, managing urine, cold, headache and improving the digestive process. While peoples living in the mountain region; starting from Tokara and Al-Marj to Al-Bayda; have more information about the uses of the different species and give more precise description of the treatment. Cancer treatment is only mentioned in Tokara. The difference between the

studied cities and areas in Libya reflect the large amount and cultural heritage between successive generations. Worth mentioned that most of the sellers in the Attar shops cannot accurately differentiate between the forms and species of *T. polium* and they call all the three taxa as Jaddah. This also noticed between the younger interviewers this beside that

some peoples inherited the knowledge from their parents as it is and this needs conducting courses for employees and shop owners by universities and scientific centers on how to use the herbal medicine to avoid any side effects from their excess usage.

Table 1: Collecting data of the different species of *Teucrium*

Taxa	Collector	Date	Location	Altitude	Endemism	Soil Texture
<i>T. apollinis</i> Maire et Weiller	A. Asker	3/2006	Shahhat Susah	356 m	Endemic	Loam
<i>T. barbeyanum</i> Aschers	A. Asker	3/2006	Shahhat Susah	356 m	Endemic	Loam
<i>T. brevifolium</i> Schreber	S. Mohamed	2/2011	Lathroun Ras-Elhellal	23 m	Not endemic	Loam
<i>T. campanulatum</i> L.	A. Asker	3/2007	Wadi-Errieg	263 m	Not endemic	Loam sand
<i>T. capitatum</i> L.	S. Mohamed	4/2013	Tarhonah	433 m	Not endemic	Loam
<i>T. davaeanum</i> Coss.	A. Asker	4/2007	Wadi El-Quttarh.	237 m	Endemic	Loam
<i>T. fruticans</i> L.	S. Mohamed	4/2011	El-Rabtta El-Assbeh	759 m	Not endemic	Loam sand
<i>T. lini-vaccarii</i> Pamp.	A. Asker	2/2007	Quasser-El Quaar	338 m	Endemic	Loam sand
<i>T. pollium</i> L. (form 1)	S. Mohamed	4/2009	Sirut.	54 m	Not endemic	Loam sand
<i>T. pollium</i> L. (form 2)	S. Mohamed	4/2011	Awllad-Hezzam village (Garian)	743 m	Not endemic	Loam sand
<i>T. pollium</i> subsp. <i>Flavovirens</i> (Batt.) S. Pucch	A. Asker	3/2007	Al-Hameida escarpment	241 m	Not endemic	Loam sand
<i>T. zanonii</i> Pamp.	A. Asker	3/2006	Dryannah	9 m	Endemic	Sand

Table 2: Medicinal use citations were organized into ten use categories

No	Use Category	Description
1	Injuries&pain	Bites, stings, cuts, burns, Wounds, headache.
2	Gastrointestinal	Stomach aches, diarrhea.
3	Respiratory	Fever, cold, cough, sore throat, allergy, chronic bronchitis.
4	Kidney stones	
5	Tumors & cancer	Any pustules in the body
6	Diabetes	

Table 3: Results of the different species of *Teucrium*

Taxa	Usage	Usage part	Preparation	RFC	UV	IAR
<i>T. apollinis</i>	2 & 4	Leaves	Tea & capsules	0.32	0.54	0.6
<i>T. barbeyanum</i>	3	Leaves	Steam bath & tea	0.11	0.23	0.6
<i>T. brevifolium</i>	5	Leaves	Poultice & tea	0.06	0.11	0.3
<i>T. campanulatum</i>	Nil	Nil	Nil	0	0	0
<i>T. capitatum</i>	1 & 2	Leaves	Juice	0.12	0.23	0.4
<i>T. davaeanum</i>	1	Aerial shoots	Poultice	0.11	0.19	0.3
<i>T. fruticans</i>	1 & 6	Leaves	Poultice & tea	0.23	0.37	0.7
<i>T. lini-vaccarii</i>	Nil	Nil	Nil	0	0	0
<i>T. pollium</i> (form 1)	1,2,3 & 6	Aerial shoots	Poultice, steam bath & tea	0.84	0.97	1.0
<i>T. pollium</i> (form 2)	1,2,3 , 4 & 6	Aerial shoots	Poultice, steam bath & tea	0.79	0.92	1.0
<i>T. pollium</i> subsp. <i>flavovirens</i>	2,3 ,4 & 6	Aerial shoots	Poultice, steam bath & tea	0.81	0.96	0.8
<i>T. zanonii</i>	4 & 6	Leaves	Tea	0.28	0.56	0.3





Plate 1: Photographs of the different *Teucrium* species under this investigation. 1. *T. apollinis*, 2. *T. barbeyanum*, 3. *T. brevifolium*, 4. *T. campanulatum*, 5. *T. capitatum*, 6. *T. davaeanum*, 7. *T. fruticans*, 8. *T. lini-vaccarii*, 9. *pollium* (form 1), 10. *pollium* (form 2), 11. *T. pollium* subsp. *Flavovirens*, 12. *T. zanonii*

Conclusions

The local people in Libya still have strong faith on herbal medicine for their disease treatments and basic needs. They use the herbs as spices and hot tea for health care. In spite of the use of the same vernacular name for all the *Teucrium* taxa, but they can differentiate between them by morphology. This investigation can help in discovering new natural drugs

Conflict of Interest

There is no conflict of interest in this work.

Author(s) Contribution

Conceptualization and supervision, W.K.Taia.
Collecting & identification of plants, A. M. Asker & S.A.H. Mohammed.

Interviewing and questionnaire, A. M. Asker, F. M. Alwashish & S. A. H. Mohamed. All authors contributed equally to this work. The manuscript was written by W.K. Taia. All authors have given approval to the final version of the manuscript.

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